REPORT

OF THE

Indian Road Development Committee

1927-28

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Note.

The total cost of the Committee, including the cost of printing the report and the evidence, is estimated to be Rs. 1,30,000.

CHAPTER I.

Introductory.

Appointment of the Committee and terms of reference.

1. At a meeting of the Council of State, held on the 9th of February 1927, the following resolution on the subject of road development was unanimously adopted :—

> "That this Council recommends to the Governor General in Council to appoint a Committee, including members of both Houses of the Central Legislature, to examine the desirability of developing the road system of India, the means by which such development could be most suitably financed, and to consider the formation of a Central Road Board for the purpose of advising in regard to, and co-ordinating the policy in respect of, road development in India."

After consultation with local Governments, the Government of India in the Department of Commerce by their resolution No. 489-T. (1), dated the 3rd November 1927*, appointed a Committee consisting of the following members of the two chambers of the Indian legislature :—

Chairman :

Mr. M. R. JAYAKAR, Bar.-at-Law, M.L.A. ;

Members :

Diwan CHAMAN LAL, M.L.A. ;
The Hon'ble Sir GEOFFREY CORBETT, K.B.E., C.I.E., I.C.S. ;
The Hon'ble Sir ARTHUR FROOM, Kt. ;
Kumar GANGANAND SINHA, M.L.A. ;
Raja GHAZANFAR ALI KHAN, M.L.A. ;
Lala LAJPAT RAI, M.L.A. ;
The Hon'ble Mr. MAHMOOD SUHRAWARDY ;
Mr. MD. ANWARUL AZIM, M.L.A. ;
Mr. MUHAMMAD ISMAIL KHAN, M.L.A. ;
The Hon'ble Dr. U. RAMA RAU ;
Mr. K. V. RANGASWAMY AYYANGAR, M.L.A. ;
The Hon'ble Sardar SHIVDEV SINGH UBEROI ; and
Mr. E. F. SYKES, M.L.A. :

with Mr. H. F. Knight, I.C.S., as Secretary and Mr. K. G. Mitchell, A.C.G.I., A.M.Inst. C.E., as Technical Adviser.

The terms of reference were as follows :—

(1) To examine the desirability of developing the road system of India and, in particular, the means by which such development could most suitably be financed ; and

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* See Appendix I.

(2) To consider, with due regard to the distribution of central and provincial functions, whether it is desirable that steps should be taken for the co-ordination of road development and research in road construction, by the formation of a Central Road Board or otherwise.

Procedure of the Committee.

2. The Committee assembled in Delhi on the 6th of November 1927 to settle its procedure. It was decided that a small touring sub-committee should first visit the provinces and collect information from local Governments, local bodies, and associations and persons interested in road development, and that the full Committee should meet at Delhi in the following January to consider the report of the sub-committee and to examine witnesses. The Committee also considered and approved the questionnaire, which is printed at the beginning of the evidence volume accompanying this report.

Tour of the sub-committee.

3. The members chosen to form the sub-committee were Sir Arthur Froom, who acted as Chairman, Kumar Ganganand Sinha and Mr. Mahmood Suhrawardy, with the Secretary and the Technical Adviser. Other members of the Committee were, if possible, to join the sub-committee in their respective provinces. The sub-committee commenced its tour on the 19th of November 1927 and visited Allahabad, Shillong, Calcutta, Patna, Nagpur, Madras and Bombay before Christmas, and Lahore early in January. It was joined by Mr. Md. Anwarul Azim in Calcutta, the Hon'ble Dr. U. Rama Rau and Mr. K. V. Rangaswamy Ayyangar in Madras, Mr. E. F. Sykes in Bombay, and Diwan Chaman Lal, Raja Ghazanfar Ali Khan and the Hon'ble Sardar Shivdev Singh Uberoi in Lahore. The sub-committee was required to submit its report one week before the meeting of the full Committee which was fixed for the 16th of January, and time did not permit a visit to Sind or to Burma. During its tour the sub-committee interviewed 15 Honourable Members and Ministers of local Governments, 40 Secretaries, Chief Engineers and other representatives of local Governments, 55 representatives of local bodies, 51 representatives of commercial and other associations and 14 private individuals.

Subsequent proceedings of the Committee.

4. The full Committee met on the 16th of January 1928 and considered the reports* submitted by the sub-committee. The oral examination of witnesses commenced on the 18th of January and continued till the end of the month. The Committee examined 63 witnesses, including an Honourable Minister, 16 Secretaries, Chief Engineers and other representatives of the Government of India and local Governments, 24 representatives of local bodies, 12 representatives of commercial and other associations and 10 private individuals. The Committee met twice during the session of the legislature, on the 6th and 12th of March. It re-assembled in Bombay on the 2nd of April and sat until the 4th to consider the evidence and formulate its conclusions, and met again in Poona from the 2nd to the 17th of July to consider its report.

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* See Appendix II.

CHAPTER II.

Indian roads in the past.

Scope of chapter.

5. From the earliest times there is record of roads and wheeled vehicles in India. Good roads, easy communications, necessarily go with civilisation and civilised administration; and Indian civilisation goes back not less than five thousand years according to the latest discoveries of the Archæological Department. We do not propose in this Chapter to give a complete review of the past history of road administration in India, but some account of the systems that existed at certain periods may be of interest.

Earliest times.

6. The Rigveda mentions the existence of highways, *mahapatha*. The excavations by the Archæological Department at Mohenjodaro in Sind and Harappa in the Punjab, cities estimated to have existed between 3500 and 2500 B.C., have revealed broad streets with a drainage system alongside them. At Harappa there was also found a miniature two-wheeled cart with gabled roof and driver seated in front, fashioned in copper, which is probably one of the oldest representations of a wheeled vehicle in the world.

> "That by the above date (3300 B.C.) city life in Harappa and Mohenjodaro was already remarkably well-organised and that the material culture of the people was relatively highly developed, is evident. Indeed, the roomy and well-built houses and the degree of luxury denoted by the presence in them of wells and bath-rooms and of an elaborate drainage system, betoken a social condition of the citizens at least equal to that found in Sumer, and markedly in advance of that prevailing in contemporary Babylonia and Egypt, where the royal monuments of the kings palaces, tombs and temples—may have been superior to anything of their class to be found in India, but where no private dwelling houses of the citizens have been discovered at all comparable with those unearthed in India."*

Mauryan period. Kautilya's Arthasastra.

7. The Epics and the Buddhistic literature, particularly the Jatakas, make frequent mention of roads and highways, but the most authoritative evidence is to be found in the political treatises of Kautilya and Sukra. Kautilya's period is definitely known, for he was the Prime Minister of Chandragupta, the first Mauryan Emperor, whose reign lasted from 322 B. C. to 298 B.C. The present Sukraniti is said to be a revised edition of an ancient text which is mentioned in Kautilya's Arthasastra. Kautilya gives rules regulating the width of roads for various

*Exhibition of Antiquities discovered by the Archæological Department during the year 1926-27, by Sir John Marshall, Director General of Archæology.

purposes and various kinds of traffic, and prescribing punishments for obstructing or defiling roads :—

"Chariot-roads, royal roads, and roads leading to dronamukha, sthaniya, country parts, and pasture grounds shall each be four dandas (24 ft.) in width. Roads leading to sayoniya (?), military stations (vyuha), burial or cremation grounds, and to villages shall be eight dandas in width. Roads to gardens, groves, and forests shall be four dandas. Roads leading to elephant forests shall be two dandas. Roads for chariots shall be five aratnis (7½ ft.). Roads for cattle shall measure four aratnis ; and roads for minor quadrupeds and men two aratnis."*

"Obstruction to roads for inferior beasts or men shall be punished with a fine of 12 panas ; to roads for superior beasts 24 panas ; to roads for elephants or to those leading to fields, 54 panas ; to those leading to any buildings or forests (setuvanapatham), 600 panas ; to those for burial grounds or villages, 200 panas ; to those for dronamukha, a fortress, 500 panas ; and those leading to sthaniya, country parts, or pasture grounds, 1,000 panas. The same fines shall be meted out in case of ploughing the several roads too deep (atikarshane chaisham) ; and ¼th of the same fines for ploughing merely on their surface."†

8. The Sukraniti also lays down rules for roads of various classes, prescribing the width and the method of construction :—

The Sukraniti.

"*Rajamargas* (royal roads) are to be constructed from the palace in all directions. The best *Rajamarga* should be thirty cubits wide, the average twenty cubits and the worst fifteen cubits only. These *Rajamargas* are both in towns and villages and used for the conveyance of marketable commodities. The *padya* or footpath is three cubits wide, the *beethi* (lane) is 5 cubits and the *marga* (road) is 10 cubits whether in town or village. These ways (*i.e.*, the *padya*, *beethi* and *marga*) should emanate from the centre of the *grama* (village) towards the east, west, north and south. The king should lay out many roads according to the number of towns. But he should not construct either a *beethi* or a *padya* in the capital. In a forest of six *yojanas* (*i.e.*, forty-eight miles) the best *Rajamarga* is to be constructed.....In each *grama* there should be roads of 10 cubits. The roads are to be made like the back of a tortoise (*i.e.*, high in the middle) and provided with bridges. And the road should be provided with drains on both sides for the passage of water. All houses must have their faces (*i.e.*, doors) on the *Rajamarga* ; and at their backs there should be *beethis*....."‡

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* Kautilya's Arthasastra, translated by R. Shamasastry, p. 60.
† Ibid, pp. 217-218.
‡ The Sukraniti, translated by Prof. B. K. Sarkar, pp. 34-35.

9. Coming to actual history, it is said that in the reign of Chandra-
Chandragupta. gupta (322—298 B.C.),—

"The roads were maintained in order by the officers of the proper department; and pillars, serving as milestones and sign-posts, were set up at intervals of 10 *stadia*, equivalent to a half *kos* according to the Indian reckoning, or 2,022½ English yards. The provision of these useful marks was made more liberally than it was afterwards by the Moghal emperors, who were content with one pillar to each *kos*. A royal, or grand trunk road, 10,000 *stadia* in length, connected the north western frontier with the capital."* (Pataliputra, the modern Patna).

Strabo, the geographer, states that Eratosthenes and Megasthenes both made their computation of the length of India from east to west from the register of stages on this royal road.

10. There is also a reference to roads in one of the rock edicts of the
Asoka. Emperor Asoka (273—232 B.C.), in which he says:—

"On the roads also banyans were planted, to give shade to cattle and men: mango-gardens were planted: and at each half-koss wells were dug: also rest-houses were made: many watering-stations also were made in this and that place for the comfort of cattle and men."†

11. The first Chinese traveller, Fa-hien, who travelled in India in the
Early travellers. beginning of the 5th century A.D., says that rest-houses for travellers were provided on the highways.‡ Mention of roads and river routes is also made by the great Chinese pilgrim Hiuen Tsang in the 7th century A.D., though by way of complaint he adds that he was in several places robbed by bandits.§

12. In the Pathan and Moghul periods the main road system received
Pathan and Moghul periods. Ibn Batuta. considerable attention, and many of the kos minars or milestones erected by the Moghul Emperors still exist. Ibn Batuta, who travelled in India during the first half of the 14th century, gives the following account of a journey performed by Sultan Kutb-ud-din, son of Sultan Ala-ud-din Khilji, who ascended the throne in 1317 A.D.:—

"After this he took a journey to Dawlat Abad, between which and Dehli is a distance of forty days. The road is from first to last inclosed with willow and other trees, so that a traveller seems to be in a garden throughout all this distance. Besides, there are at the distance of every three miles the stations of the foot couriers, at which there are also inhabitants, as already mentioned. From this place to El Telingana, and El Maabar, is a distance of six months. In all these stations there is a lodging for the Emperor,

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* The Early History of India, by V. A Smith,—4th Edition, p. 142.
† The Cambridge History of India, Vol I, p. 510.
‡ The Early History of India, by V. A. Smith,—4th Edition, p. 312.
§ Histoire de la Vie De Hiouen Thsang, by Stanislas Julien, pp. 259-260.

with cells for his suite, and for travellers generally. There is no necessity, therefore, for a poor man's carrying any provisions with him on this road."*

13. In the Tarikh-i-Sher Shahi, it is stated of the Emperor Sher Shah, who reigned from 1540 A.D. to 1545 A.D., that—

The Tarikh-i-Sher Shahi.

"For the convenience in travelling of poor travellers, on every road, at a distance of two *kos*, he made a *sarai*; and one road with *sarais* he made from the fort which he built in the Panjab to the city of Sunargaon, which is situated in the kingdom of Bengal, on the shore of the ocean. Another road he made from the city of Agra to Burhanpur, which is on the borders of the kingdom of the Dekhin, and he made one from the city of Agra to Judhpur and Chitor; and one road with *sarais* from the city of Lahore to Multan. Altogether he built 1,700 *sarais* on various roads; and in every *sarai* he built separate lodgings, both for Hindus and Musulmans, and at the gate of every *sarai* he had placed pots full of water, that any one might drink; and in every *sarai* he settled Brahmans for the entertainment of Hindus, to provide hot and cold water, and beds and food, and grain for their horses; and it was a rule in these *sarais*, that whoever entered them received provision suitable to his rank, and food and litter for his cattle, from Government. Villages were established all round the *sarais*. In the middle of every *sarai* was a well and a *masjid* of burnt brick; and he placed an *imam* and a *mua'zzin* in every *masjid*, together with a custodian (*shahna*), and several watchmen; and all these were maintained from the land near the *sarai*. In every *sarai* two horses were kept, that they might quickly carry news. I have heard that Hussain Tashtdar once, on an emergency, rode 300 *kos* in one day. On both sides of the highway Sher Shah planted fruit-bearing trees, such as also gave much shade, that in the hot wind travellers might go along under the trees; and if they should stop by the way, might rest and take repose. If they put up at a *sarai*, they bound their horses under the trees."†

14. The main roads of Moghul India are described in the Chahar Gulshan, which was written in the middle of the eighteenth century and is quoted by Professor Sarkar in his India of Aurangzib :—

The Chahar Gulshan.

"The *Chahar Gulshan* gives the stages of the following 24 roads, of which the first 13 have been traced either fully or in great part. Of the remaining 11 roads, a few of the stages have been identified, but they do not enable us to trace accurately the alignment of these highways. In the case of some of the latter class, we encounter the further difficulty of not knowing for

* The Travels of Ibn Batuta, translated by the Rev. Samuel Lee, pp. 122-123.
† The History of India, by Sir H. M. Elliot, Vol. IV, pp. 417-418.

certain where the road begins and where it ends and the relative positions of the different stages.

Roads mainly traced.

1. Agra-Delhi.
2. Delhi-Lahor.
3. Lahor-Gujrat-Atak.
4. Atak-Kabul.
5. Kabul-Ghazni-Qandahar.
6. Gujrat-Srinagar.
7. Lahor-Multan.
8. Delhi-Ajmir.
9. Delhi-Barili-Benares-Patna.
10. Delhi-Kol.
11. Agra-Allahabad.
12. Bijapur-Ujjain.
13. Sironj-Narwar.

Roads partly traced.

14. Aurangabad-Ujjain ?
15. Golkonda-Asir-Hindia.
16. Hindia ?-Sironj.
17. Narwar ?-Gwalior-Dholpur ?
18. Dholpur-Agra ?
19. Multan-Bhakkar.
20. Srinagar-Atak.
21. Ajmir-Ahmadabad ?

Roads not traced at all.

22. Surkhab-Kabul.
23. Qandahar ?-Multan.
24. Qandahar ?-Atak."*

15. Travellers from Europe experienced little difficulty in moving through India in Moghul times. William Finch, a merchant, who travelled from Surat to Agra in 1608, left an account of his journey :—

European travellers. William Finch.

"At Burhanpur the road left the Tapti and struck north-west for Mandu and Malwa, crossing the Satpura range and the Narbada river, and then ascending the steep scarp of the Vindhyas. The track was very bad, successive marches being described as "stony and steep way", "stony troublesome way", "bad way", and "steep way"; while the ascent to Mandu was "up a steep stony mountain, having way but for a coach at most." After Mandu there was one more bad stage, and then a good road to Ujjain."†

16. Tavernier‡ whose travels in India extended from 1640 to 1667, normally journeyed in a carriage drawn by trotting bullocks, and considered travel in India quite as comfortable as in Europe. He describes the following routes in use in the Moghul period :—

Tavernier.

1. Kandahar-Multan.
2. Kandahar-Kabul-Lahore-Delhi-Agra.
3. Agra-Sasseram-Patna-Dacca (from Patna much of the journey was made by river).
4. Surat-Burhanpur-Gwalior-Agra.
5. Surat-Ahmedabad-Jalor-Biana-Agra.
6. Surat-Aurangabad-Golconda.

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* The India of Aurangzib, by Prof. Jadunath Sarkar, p. xcvi.
† India at the death of Akbar—An Economic Study, by W. H. Moreland, p. 44.
‡ Travels in India, by Jean Baptiste Tavernier.

7. Aurangabad-Burhanpur.
8. Golconda-Masulipatam.
9. Surat-Goa (mostly by sea).
10. Goa-Bijapur-Golconda.
11. Masulipatam-Gandikot.
12. Gandikot-Golconda.

But the roads generally did not permit the free movement of commerce at all seasons.

> "Traffic was practically at a standstill during the rains, and was reduced to small limits during the hot weather, when fodder and water were difficult to get, so that we find an English merchant at Surat complaining that there were four hot and four wet months, "in which time there is no travelling and therefore unfit for commerce". A striking illustration of the influence of the seasons is given by Tavernier in discussing the alternative routes from Surat to Agra. The western road through Rajputana was in his time the more dangerous of the two, owing to the attitude to travellers adopted by the chiefs and tribes, but it was nevertheless preferred by merchants whose time was limited; lying through sandy country with few rivers, it could be traversed directly the rains ceased, while the safer eastern road through Malwa was impassable for nearly two months owing to the heavy soil and the frequent obstacles presented by rivers still in flood. The ordinary traveller therefore would prefer to stay in Surat till the country had dried up, and then pursue his journey through Burhanpur and Gwalior, but a merchant who took this course could not return to Surat in time to sell the goods which he brought from Agra before the shipping season was over, and on the upward journey therefore he faced the greater risks of the western route. Later in the season the position was reversed; there was then little fodder or water to be had in Rajputana, and in the absence of special reasons travellers from the north naturally chose the road through Malwa, which presented fewer difficulties."*

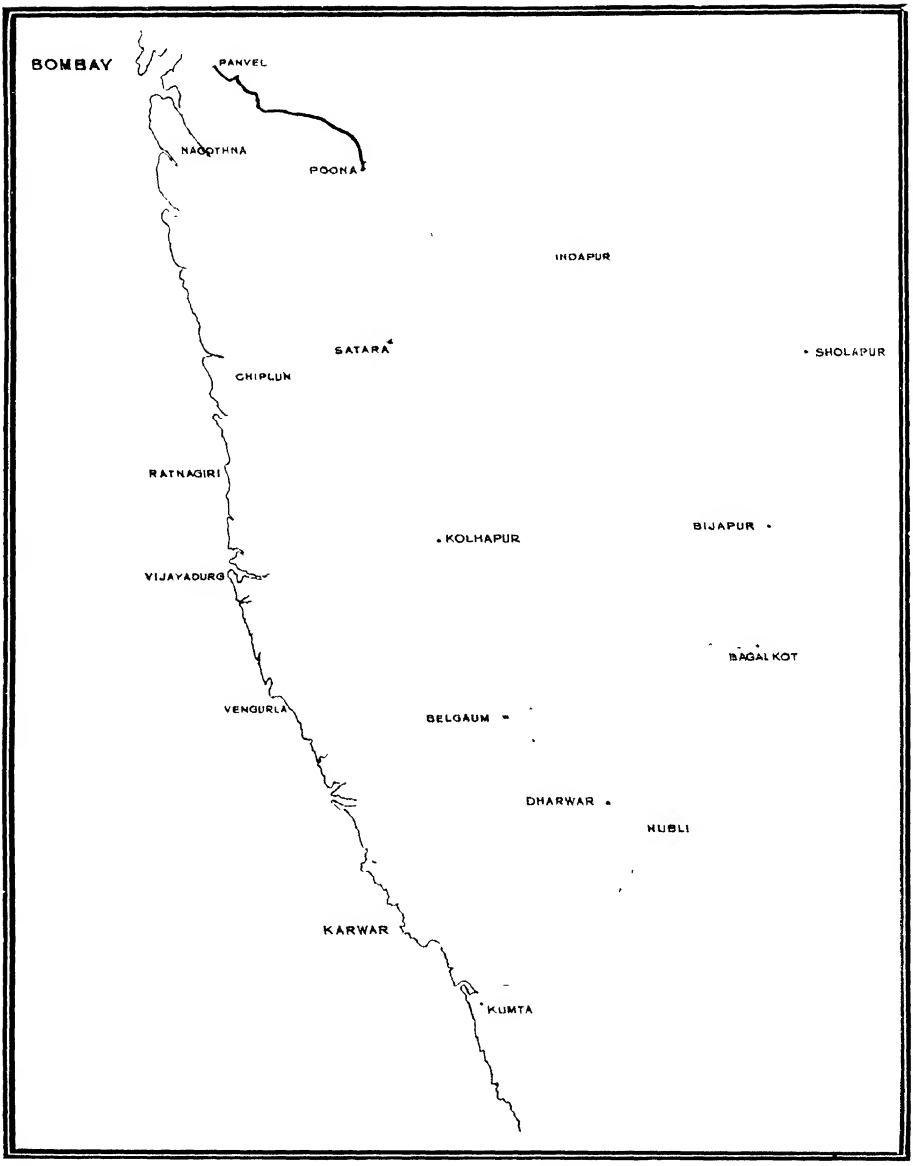
Nineteenth century.

17. During the last century and prior to the introduction of railways, a number of trunk roads, bridged and metalled, were constructed and maintained under the supervision of military engineers, connecting the more important military and commercial centres. The developments that were inaugurated during the Governor Generalship of Lord William Bentinck (1828—35) were continued and extended by Lord Dalhousie (1848—56).

> "A particularly inefficient body called the Military Board, which was supposed to look after public works, was suppressed, and the Department of Public Works (P. W. D.) was constituted nearly in its existing form. The expenditure on public work, which had been on the most niggardly scale, was enormously

* India at the death of Akbar—An Economic Study, by W. H. Moreland, p. 242.

SKETCH MAP OF
KONKAN AND BOMBAY DECCAN
SHOWING ROADS IN 1851-52
(Scale 64 Miles – 1 Inch)



REFERENCES—

METALLED ROADS ———————

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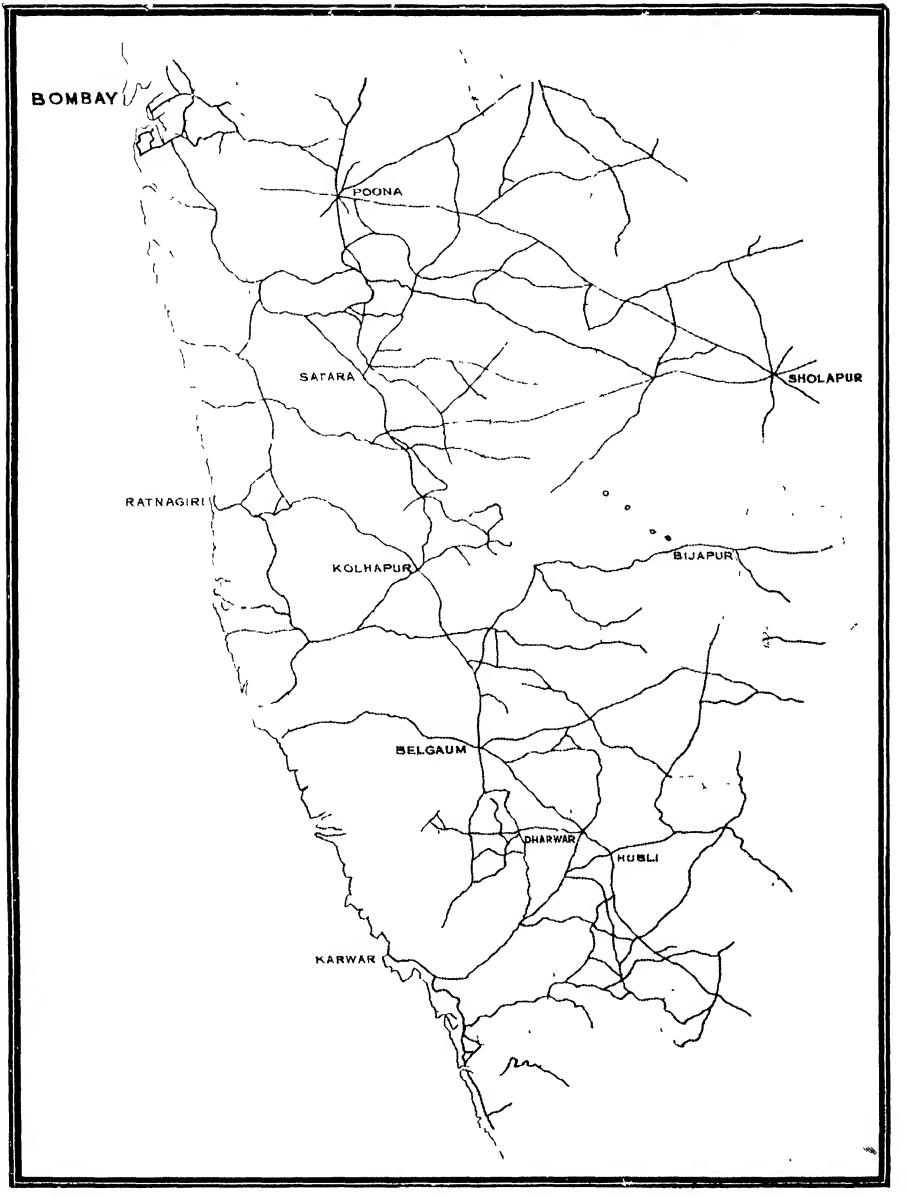
COUNTRY TRACKS NOT SHOWN

SKETCH MAP OF
KONKAN AND BOMBAY DECCAN
SHOWING ROADS IN 1927
(Scale 64 Miles = 1 Inch)



REFERENCES –

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UNMETALLED ROADS

COUNTRY TRACKS NOT SHOWN

increased, and works of great magnitude, such as the Grand Trunk Road, were undertaken."*

With the advent of railways, however, attention was concentrated on the construction of feeder roads at right angles to them, and the trunk roads, especially where parallel to the railways, were in some cases allowed to go out of repair. There was a great increase in metalled feeder roads and roads of local importance. Sir Richard Temple in his India in 1880 estimates that there were in that year not less than 20,000 miles of metalled and partially bridged roads in India. There are now 59,000 miles of surfaced roads in British India. The two maps (facing this page) illustrate the development of roads in a part of western India during the last 75 years.

* The Oxford History of India, by V. A Smith,—2nd Edition, p. 707.

CHAPTER III.

Indian roads to-day.

Statistics.

18. Statements A to K in Appendix III have been compiled from the statistical information furnished by local Governments and Administrations in their replies to our questionnaire. The Committee's enquiry did not extend to Indian States. Roads in municipal areas are also excluded. The figures relate to extra-municipal roads maintained from provincial revenues and from local funds, and also in some statements to the roads in minor provinces and administrations which are maintained from central revenues. The statements show that conditions vary considerably from province to province, and provincial variat ons are illustrated in the diagrams facing this page. It will be sufficient now to summarise the aggregates.

Road mileage according to classes and types. (Statement A).

19. Excluding roads in municipal areas, roads in British India may be roughly divided into the following five classes :—

(1) Roads wholly or mainly maintained from provincial revenues ;

(2) Roads maintained from local funds, that is, from the funds of district councils or boards, with grants-in-aid from provincial revenues ;

(3) Roads maintained from local funds ;

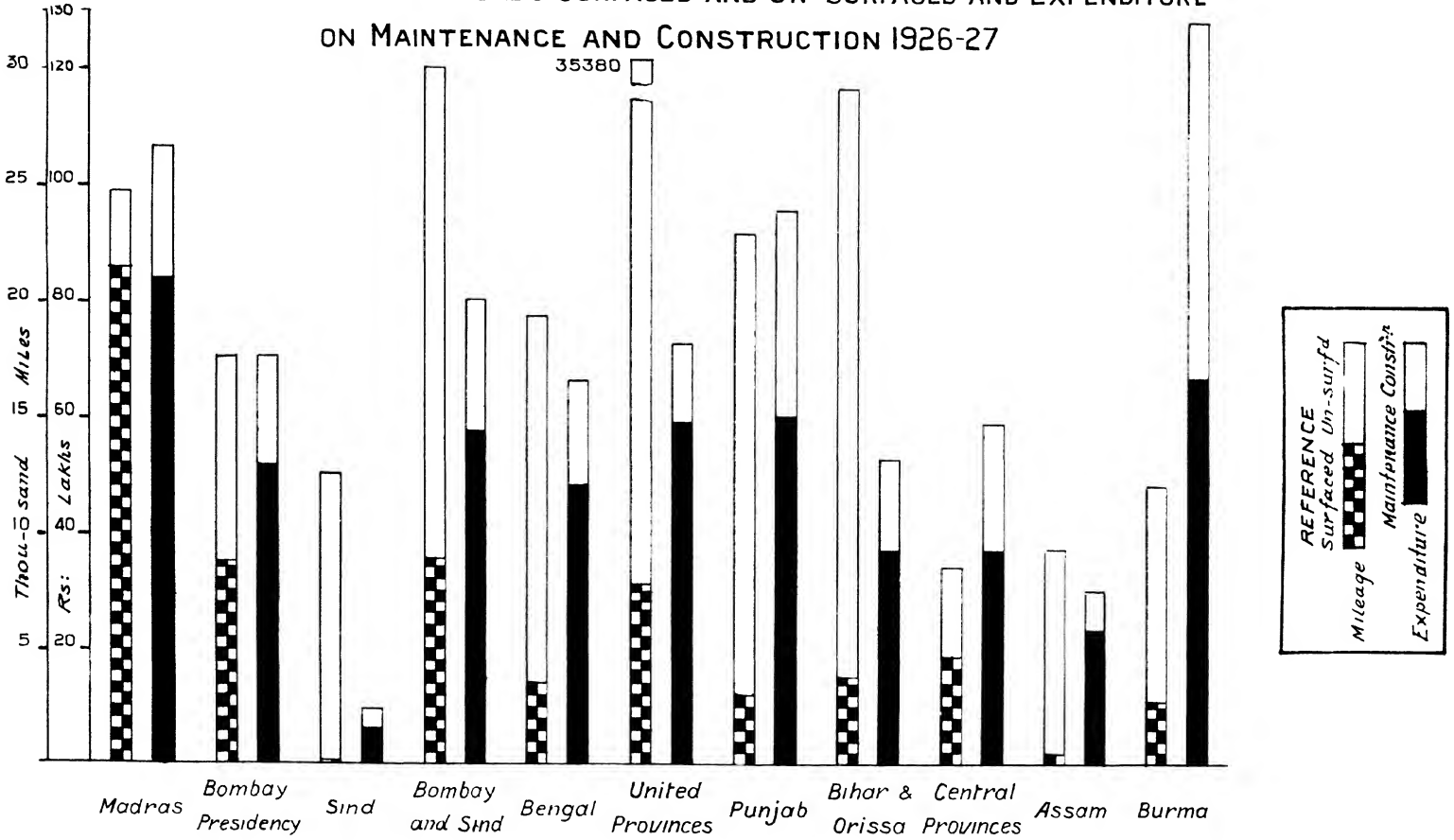
(4) Roads maintained by minor local bodies such as union boards and village panchayats ;

(5) Roads maintained by the villagers themselves.

Figures have been furnished by local Governments for the first three classes only, but the line dividing classes (3) and (4) does not appear to have been drawn on the same principles in all provinces. The distinction between classes (4) and (5) is even more vague. For the purposes of the statements, roads in class (1) are described as provincial, and roads in classes (2) and (3) as local, and there is a further sub-division according to types into surfaced and unsurfaced. The total road mileage in British India according to these classes and types is :—

	Provincial.	Local.	Total.	Percentage of total.
	Miles.	Miles.	Miles.	
Surfaced	26,850	32,260	59,110	29·6
Unsurfaced	20,920	119,110	140,030	70·4
Total ..	47,770	151,370	199,140	..
Percentage of total ..	23·8	76·2	..	..

Diagram No. 1 Mileage of Roads Surfaced and Un-surfaced and Expenditure on Maintenance and Construction 1926-27



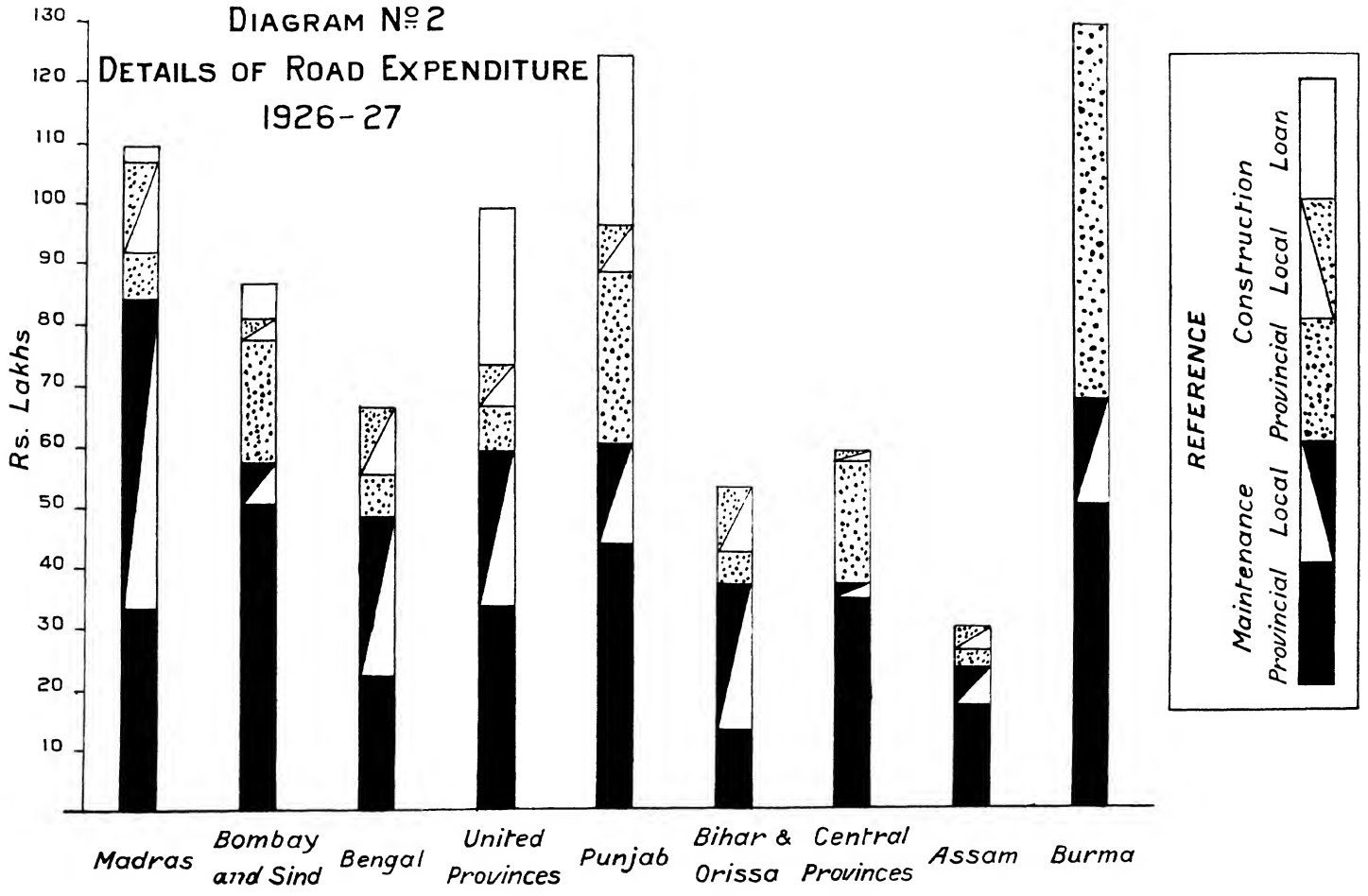


DIAGRAM No. 2
DETAILS OF ROAD EXPENDITURE
1926-27
Rs. Lakhs
130
120
110
100
90
80
70
60
50
40
30
20
10
Madras
Bombay and Sind
Bengal
United Provinces
Punjab
Bihar & Orissa
Central Provinces
Assam
Burma
REFERENCE
Maintenance
Provincial
Local
Construction
Provincial
Local
Loan

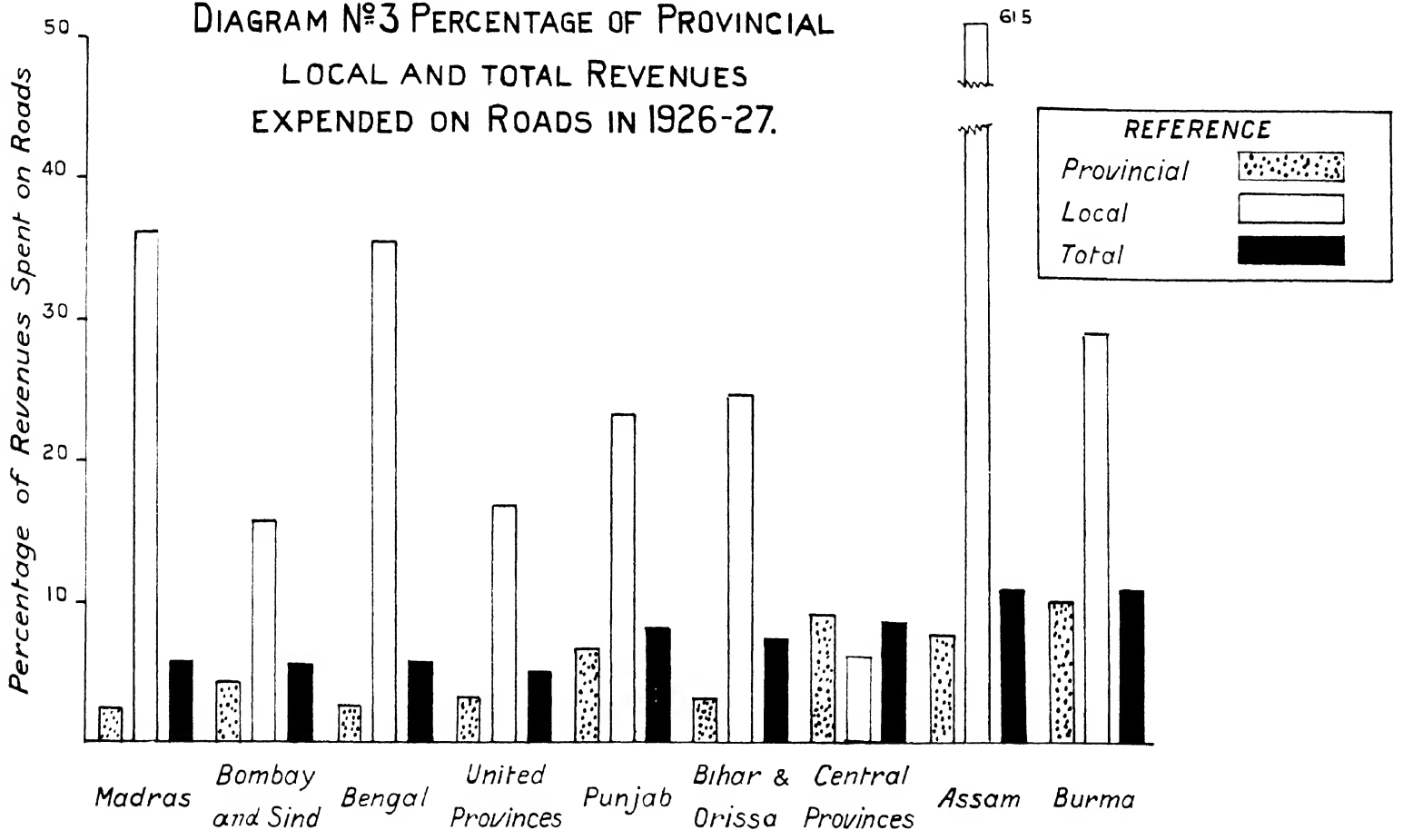


DIAGRAM No 3 PERCENTAGE OF PROVINCIAL
LOCAL AND TOTAL REVENUES
EXPENDED ON ROADS IN 1926-27.
615
REFERENCE
Provincial
Local
Total
Percentage of Revenues Spent on Roads
50
40
30
20
10
Madras
Bombay and Sind
Bengal
United Provinces
Punjab
Bihar & Orissa
Central Provinces
Assam
Burma

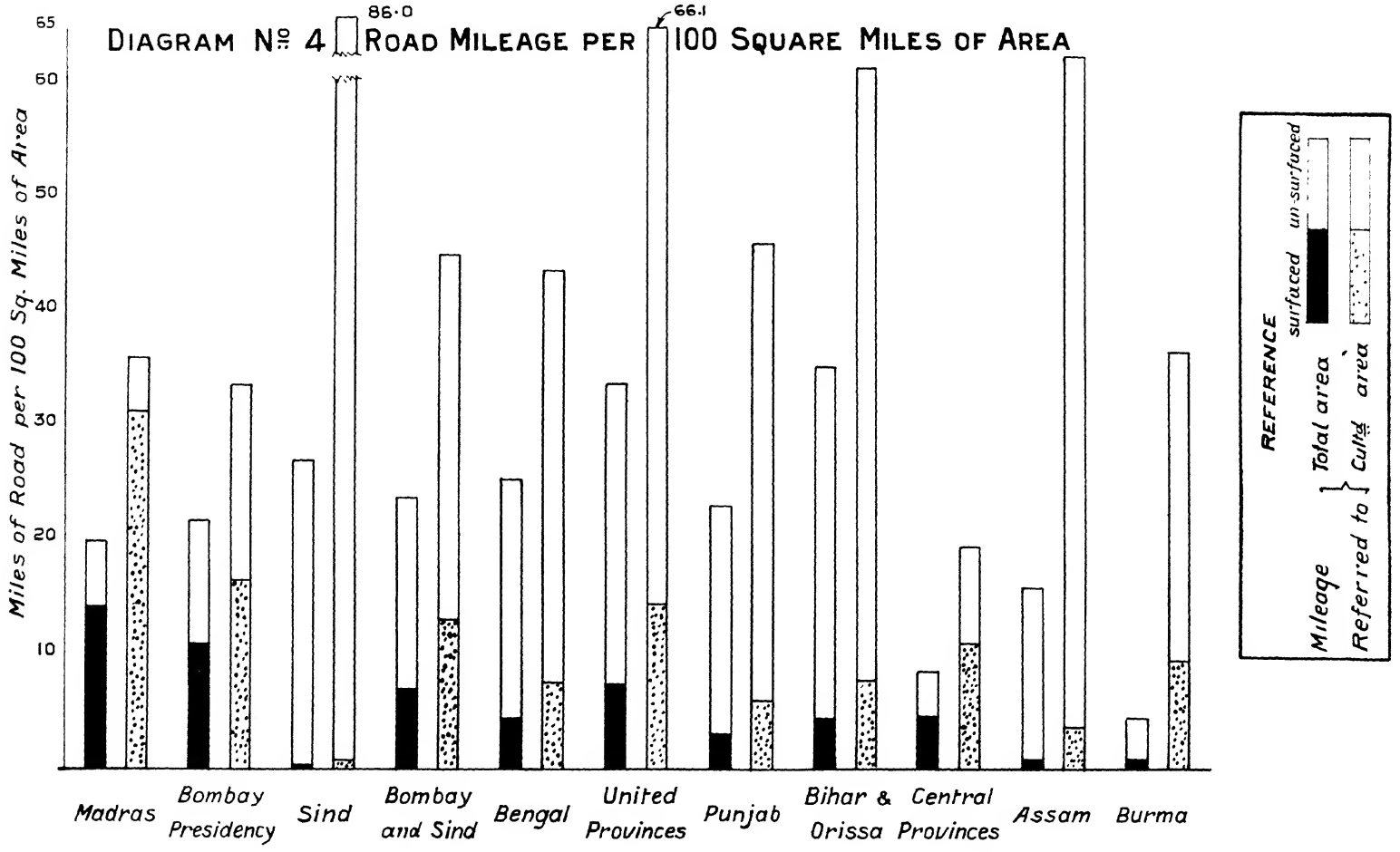
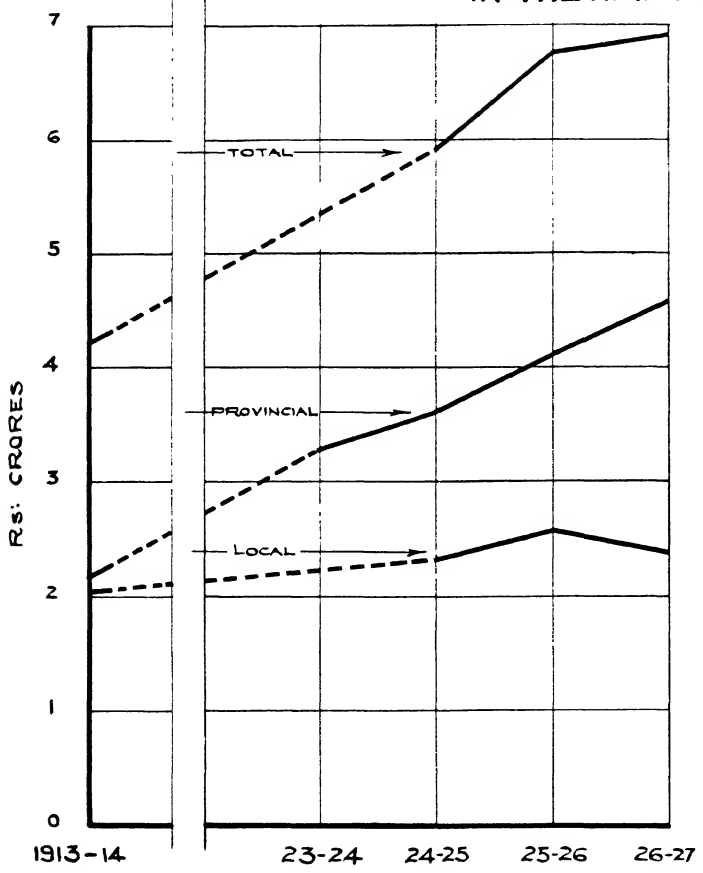
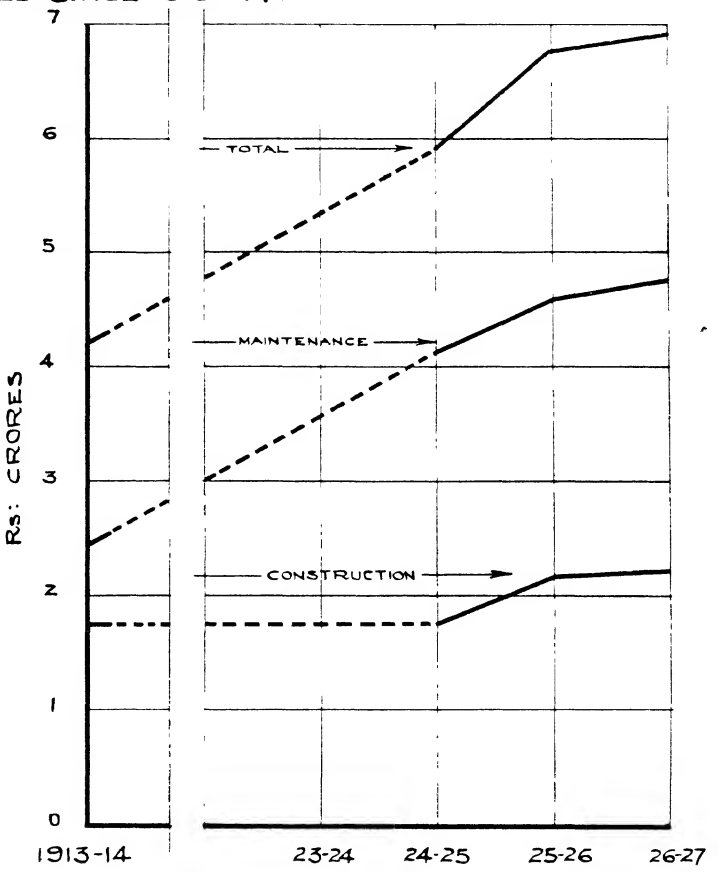


DIAGRAM No. 4 ROAD MILEAGE PER 100 SQUARE MILES OF AREA
86·0
66·1
Miles of Road per 100 Sq. Miles of Area
65
60
50
40
30
20
10
Madras
Bombay Presidency
Sind
Bombay and Sind
Bengal
United Provinces
Punjab
Bihar & Orissa
Central Provinces
Assam
Burma
REFERENCE
surfaced
un-surfaced
Mileage
Referred to
Total area
Cultd. area

Diagram No. 5 Growth of Road Expenditure from Revenue in the Nine Provinces since 1913-14.





It should be observed that the omission from these figures of the large but unascertained mileage in classes (4) and (5) tends to vitiate comparison with the statistics of other countries which are more complete.

Road mileage according to area and population. (Statements B and C).

20. In considering the average road mileage according to area and population, it is necessary to allow for the large proportion of the total area which is either uncultivated or under forest, and for the density of the population. In the nine Governors' provinces 41 per cent of the total area is cultivated, and the density of the population is 235 to the square mile. The average road mileage for every 100 square miles of the total area and of the cultivated area, and for every 100,000 of the population, is :—

	Per 100 square miles of		Per 100,000 of population.
	Total area.	Cultivated area.	
	Miles.	Miles.	Miles.
Surfaced	5·45	13·30	23·20
Unsurfaced	13·05	32·10	55·70
Total ..	18·50	45·40	78·90

Road expenditure. (Statements D and E).

21. The total expenditure from revenue on roads in 1926-27, in lakhs of rupees, was :—

	Provincial.	Local.	Total.
Construction	1,67·43	61·36	2,28·79
Maintenance	3,36·94	1,77·28	5,14·22
Total ..	5,04·37	2,38·64	7,43·01

In addition, there was capital expenditure on construction amounting to Rs. 61·79 lakhs, of which Rs. 58·97 lakhs were provincial and Rs. 2·82 lakhs local. The percentage of total revenues spent on roads, and the incidence per head of the population, in 1926-27 were as follows :—

	Provincial.	Local.	Total.
	Per cent.	Per cent.	Per cent.
Percentage of total revenue ..	5·0	24·8	7·0
	Annas.	Annas.	Annas.
Incidence	3·0	1·7*	4·5

* Calculated on rural population only.

22. The growth of expenditure on roads in recent years has been marked. The following table gives for the nine Governors' provinces the total expenditure from revenue in 1913-14 and in each of the four years ending 1926-27, and also the percentage of increase :—

Growth of road expenditure and surfaced mileage. (Statements F to H).

Year.	Provincial.	Index.	Local.	Index.	Total.	Index.
	Rs. lakhs.		Rs. lakhs.		Rs. lakhs.	
1913-14 ..	216·3	100	204·8	100	421·1	100
1923-24 ..	324·8	150	..	..	..	..
1924-25 ..	360·1	167	229·1	112	589·2	140
1925-26 ..	408·0	189	265·8	130	673·8	160
1926-27 ..	456·3	210	237·7	116	694·0	164

This increase is partly due to the higher cost of maintenance, owing to the rise in prices since 1913-14 and also to the greater strain thrown on roads by the development of motor traffic. Expenditure was allocated to construction and maintenance as follows :—

Year.	Construction.	Index.	Maintenance.	Index.
	Rs. lakhs.		Rs. lakhs.	
1913-14 ..	174·4	100	246·7	100
1923-24 ..	..	..	..	..
1924-25 ..	177·0	102	412·2	167
1925-26 ..	215·4	124	458·4	186
1926-27 ..	221·2	127	472·8	191

In the nine provinces, the increase in the mileage of surfaced roads during this period was as follows :—

Year.	Mileage of surfaced roads.	Index.
1913-14	50,075	100
1923-24	53,421	106
1924-25	53,629	107
1925-26	54,864	109
1926-27	56,560	113

Administration.

23. Roads in the nine Governors' provinces are a provincial subject, and in all except Assam are a transferred subject, that is, administered by the Governor acting with Ministers. Under the Devolution Rules the Governor General in Council has power 'to declare that any road is of military importance, and to prescribe in respect thereof the conditions subject to which it shall be constructed or maintained'. But hitherto this power does not appear to have been exercised, and the Governor General in Council is directly concerned only with the 7,000 miles of roads in minor provinces and administrations. 'Provincial' roads are ordinarily maintained through the agency of the Public Works Department; but in some provinces, particularly in Madras, considerable lengths are maintained through the agency of the district councils or boards, which receive payments from provincial revenues for this purpose. 'Local' roads are maintained by district councils or boards. As the figures in Statement A indicate, the extent to which the administration of roads has been delegated to district councils varies considerably from province to province. But in British India as a whole, including provincial roads which are maintained through their agency, about 80 per cent of the total mileage is now administered by district councils. In addition, district councils have certain responsibilities in respect of the unascertained mileage maintained by minor local bodies. The roads maintained by the villagers themselves are rough lanes and field cart-tracks, for which there is little organised administration.

Finance.

24. Provincial roads are financed from the general revenues of the province. The proposals of the local Government for appropriations in any year are submitted to the vote of the local Legislative Council in the form of demands for grants; and as roads are a transferred subject, if a demand is refused or reduced, it cannot be restored. Local roads are financed mainly from local funds, which are derived principally from a cess calculated on the land revenue, which is paid only by landholders.* The extent to which district councils or boards receive contributions from provincial revenues, varies from province to province. Details for 1926-27 are given in Statement K. Contributions are also sometimes made by district councils to minor local bodies. It will be seen from Statement E that the percentages of provincial revenues and local funds spent on roads differ considerably in different provinces.

In addition, construction is sometimes financed from provincial or local loans. In Madras it is stated that the construction of new roads is generally so financed; and in the United Provinces a three year programme, mainly of reconstruction, is being financed from loans. In Bombay, where the cost of a scheme of road construction including the construction of bridges amounts to Rs. 5 lakhs or over, it is met from loans. In the Punjab the construction of certain major bridges is debited to capital account, and also the construction of certain roads in areas which are being developed under new irrigation schemes. As a general rule, however, the Government of the Punjab is of opinion that road development should be financed from revenue.

* Mr. K. V. Rangaswamy Ayyangar considers that local expenditure is unfair in its incidence on landholders.

Road boards.

25. Until recently road development was generally local in its outlook and objects. Road programmes in many provinces were framed for a district or division. In the last few years, however, partly owing to the extension of motor transport, wider considerations have been recognised, and in most provinces road or communications boards have been constituted to co-ordinate local programmes and evolve a provincial policy. These boards are usually advisory to local Governments, but in the Punjab and in Burma financial powers of sanction have in certain cases been delegated to them.

Road conditions in India.

26. It is difficult to give a concise account of conditions in a country so vast as India and varying so widely in its physical characteristics and climate. In some parts it is easy to make at small cost a road which is passable for traffic of all kinds for the greater part of the year; in other parts it is impossible, except at a very heavy cost, to make a road which is passable even for bullock carts during several months of the year. In Bengal and Assam, the country is almost impassable during the heavy rains; and the network of waterways would make the cost of bridged roads almost prohibitive, while the waterways themselves provide an alternative system of communications. In Orissa, floods are so frequent that roads are built on embankments, which may be washed away for many miles at a time. In the Gangetic plain, and again in a great part of the Punjab, the absence of road-metal makes the construction of metalled roads expensive and difficult. On the other hand, much of the Punjab is so flat and dry that unmetalled roads will serve most purposes. In parts of the province, however, and in Sind, sand obstructs wheeled traffic and makes road construction very costly. The coastal belt of the Bombay Presidency is intersected by rivers and creeks, and the steep ghats behind are difficult to pass. In the Central Provinces and the Deccan, the deep 'black-cotton' soil of the valleys alternates with rocky hills, which provide an ample supply of road-metal. But the many rivers flowing across the peninsula, and their tributaries, are obstacles which increase in difficulty as they approach the coast of Madras. Across the Bay of Bengal, the sparsely populated province of Burma is surrounded by an almost impenetrable belt of hill and forest, which has hitherto been an effective barrier to through road communication with India. Finally, the trade routes to Central Asia through the Himalaya are narrow mountain paths, blocked for many months of the year by deep snow.

If there are any conditions that may be said to be common to most parts of India, they are these. In the first place, roads which would otherwise be a fair means of communication, are frequently interrupted by a river-crossing or stream bed, which seriously restricts the practicable load on a vehicle even in the open season. Secondly, the surface of unmetalled roads during the rains is liable to be reduced to an impassable morass.

Traffic on Indian roads. The bullock cart.

27. This diversity of local conditions is reflected to some extent in the traffic on Indian roads. In the Himalaya, goods are carried on pack animals, mules, ponies, yaks and even sheep and goats. In the sandy tracks of north-west India, camels are commonly used for both goods and passengers. And in northern India much passenger traffic is carried in pony

ekkas and tongas. But generally speaking, throughout India the bullock cart is the ordinary means of transport, and is well adapted to the needs of the country. It is strongly constructed and is not easily damaged by bad roads; it is made from materials which are available almost everywhere and by artisans who are found in almost every village; and in case of breakdown repairs can easily be effected. Further, the cultivator, who is the chief user of the roads, has his own agricultural bullocks which can be employed for purposes of transport when not working in the fields. On the other hand, the ordinary bullock cart is very slow, and it is sometimes argued that the employment of agricultural cattle for road transport may impose on them an additional strain which may be found to be economically wasteful. It is also complained that the narrow iron tyres frequently fitted to bullock carts do much damage to the roads and add substantially to the cost of road maintenance.

Motor traffic. (*a*) Passengers.

28. The figures in Statements L, M and N of Appendix III will convey some idea of the rapid growth of motor traffic in recent years. The number of motor vehicles of all kinds imported into India has risen from 4,419 in 1913-14 to 25,950 in 1927-28; and the consumption of petrol in India has increased from 4⅓ million gallons in 1913-14 to 50 million gallons in 1927-28. The annual consumption of petrol has risen by 137 per cent since 1924-25, and now appears to be increasing every year at the rate of about 30 per cent compound interest. This rapid increase is largely due to the sudden and remarkable development of motor passenger services during the last two or three years. These services are penetrating to every motorable road throughout the country, metalled or unmetalled, and may run comparatively long distances, sometimes even competing with the railway. The type of car most commonly used is a light chassis, frequently with a country-made body, holding about 8 to 16 passengers. The heavy omnibus is seldom seen outside large towns and their immediate environs.

(*b*) Goods

29. Motor transport for goods is increasing in important commercial towns and is especially useful where there are sanitary or other objections to the stabling of large numbers of bullocks. But there is no indication at present of any marked extension elsewhere. The bullock cart has definite advantages for short distances, and for long distances the motor lorry cannot at present compete with the railway. There are, however, cases in which motor transport for goods is developing or is likely to develop in the near future. There are routes, especially in hill tracts, where railway construction would not be economical, but a motorable road is possible. For instance, a motor lorry service is running on the road between Shillong and Pandughat, and carries the whole of the khasi potato crop. Another opportunity for motor transport is the carriage of goods in the vicinity of large towns and, in particular, the supply of perishable produce such as milk and vegetables from the surrounding country, for which railway facilities are not always sufficient.

Effect of motor traffic on roads

30. The development of motor traffic is revolutionising the road problem in India. Roads of water-bound macadam are proving inadequate for combined bullock cart and motor traffic. It is complained, on the one hand, that roads are

deteriorating owing to the increase in motor traffic, and that money for repairs is not available. On the other hand, it is objected by motor-owners that their vehicles are damaged by bad roads, and that the development of motor services is hampered by the inadequacy of the existing road system. It has been said that "there are moments in the history of the Road in any society where the whole use of it, the construction of it, and its character have to be transformed. One such moment, for instance, was when the wheeled vehicle first appeared : another when there first appeared large organised armies. It occurred whenever some new method of progression succeeded the old."* It has been seen how roads in India were affected by the construction of railways. With the development of motor transport a new method of progression has appeared, and a further revision of the road system is becoming necessary in order to meet its requirements.

Defects in the existing road system.

31. We have received much evidence on the state of roads in India at the present time, and the defects in the existing system. It is unnecessary here to refer in detail to many complaints which are mainly of local significance. The defects that are summarised below may be taken to apply to India generally.

In the first place, there has been, at any rate until recently, a lack of system and continuity in road programmes. This is the natural result of an outlook which was concentrated primarily on purely local needs, and was limited by the range of movement of the bullock cart and the provision of short feeders to railways. But with the development of motor transport there is a demand for an extended range of movement, and for a coherent system which will unite broken and disconnected lengths into a continuous whole.

Secondly, the lack of bridges and crossings is a serious obstacle to traffic of all kinds. Apart from the inconvenience, waste of time and possible damage to bullocks, the absence of a bridge may seriously reduce, even in the dry season, the load which a bullock cart could carry without difficulty along the rest of a road, and so may diminish the economic value of the road as a whole. And during the rains an unbridged river may render a road altogether useless. Motor transport is even more seriously hampered. A crossing may perhaps be forced in an occasional emergency, but regular motor services cannot be satisfactorily established on an unbridged road.

Thirdly, road surfaces are said to be deteriorating, and here again the problem is aggravated by the development of motor transport. On the one hand, motor transport demands improved surfaces; and on the other hand, its development is damaging the surfaces that already exist. The question of surfaces, the evolution of a 'dual purpose' road, and especially the improvement of unmetalled roads, require systematic experiment and scientific research, for which organised provision does not always exist.

Finally, it is generally agreed that the condition of subsidiary roads connecting villages with main roads and with one another requires special consideration and relief. Apart from the immediate benefit to the villagers, it is obvious that main roads themselves will not develop their full economic value unless they are accessible to the villages of the tract through which they pass.

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* The Road, by Hilaire Belloc (Author's Introduction).

Road maps.

32. A road map of India, on a scale of fifty miles to one inch, has recently been prepared by the Surveyor General of India ; and with his permission a copy accompanies this report to illustrate the present road system. We have also been shown proofs of specimen guide maps, on a scale of ten miles to one inch, in book form, which would be of great service to road users and to all who are interested in road development.

CHAPTER IV.

The desirability of developing the road system of India.

Marketing of agricultural produce.

33. The evidence that we received was unanimous that the road system of India should be further developed and improved. Different witnesses stressed different points of view, but the point on which there was perhaps most general insistence was the need of better communications for marketing agricultural produce. This aspect of the road question has also been considered recently by the Royal Commission on Agriculture in India. In paragraph 298 of its report the Commission says :—

> "Good communications, in combination with efficient marketing arrangements, enable produce to be moved cheaply and quickly to places where the demand for it is active and secure the equalisation of prices for particular classes of produce throughout the country, and both these factors react favourably on the price which the average cultivator receives. They frequently open out to him alternative markets and the element of competition between market and market that follows usually operates greatly to the advantage of the producer. Defective communications between the point of production and the local market hinder the movement of goods and make primary marketing costly, the additional charge ordinarily falling upon the shoulders of the cultivator. In extreme cases, difficulty of communications may leave the cultivator entirely at the mercy of the local dealer who alone has at his command enough pack or cart bullocks to undertake the transport of produce to the nearest market."

The Commission further points out that efficient communications exercise an immediate effect on the factor of time, which is an essential element in the price factor. Good communications in any area will often bring new crops within the range of profitable cultivation. In fact, it has been the improvement in communications since the middle of the nineteenth century that, more than any other factor, has brought about the change from subsistence farming to the growing of money crops, such as cotton, jute, groundnut and tobacco. The Commission also emphasises the point that bad communications, by imposing a constant strain on the health and stamina of the draught animals, seriously reduce their efficiency for the all-important work of cultivation. Finally, bad communications not only hamper the agriculturist in the marketing of his produce, but also raise the price of his own purchases from elsewhere. In short, the Commission concludes, the true income of the cultivator is largely dependent on the efficiency of communications.

Social and political progress.

34. The social and political effect of good communications, especially on the rural population, is not less important than the economic. It is unnecessary to elaborate this aspect of road development. It is commonplace that social and polit-

ical progress is advanced by intercourse, and retarded by isolation. The far-reaching potentialities of motor transport are beginning to be rea ised. As one witness put it, " Good roads annihilate distances. Instead of counting by miles, we begin to count distance by time. Twenty to thirty miles is now an hour's distance. "* It is difficult to foresee, and difficult to exaggerate, the effect on the life of the nation of this annihilation of distance and the consequent awakening of the rural population.

Roads and railways.

35. In some countries the competition of motor transport with railways has become an acute question. And as railways in India are mainly State-owned, it has even been objected that the development of roads would injure a valuable national property. This, however, is not the view of the railway administration, which is summed up as follows :—

> " Broadly speaking the railway regards all new road construction favourably as an extension of the transport facilities of the country and therefore in the majority of cases tending to bring more traffic to the railway. Taking a wide view, it is only exceptionally that new road construction would result in decreasing traffic on the railway. "†

It is admitted that certain lengths of railway, where a road runs parallel or on interior lines, have suffered from motor competition in the carriage of passengers. For instance, between Lahore and Amritsar, during the summer of 1927 third class passenger receipts fell by nearly 60 per cent. But it is considered that over long distances the railways can more than hold their own both for goods and passengers. Over short distances whatever mode of transport is most economical or convenient should be available, while motor competition tends to stimulate improvement in the railway services provided. The railway administration would prefer that more attention should be paid to ' radial ' roads, which feed the railways, than to through roads which may compete with them. But here again it is recognised that through roads are the backbone of any coherent road system. The attitude of the railway administration is thus stated in the memorandum submitted to the Committee by the Railway Board :—

> " Generally speaking any scheme by which the development of the road system of India will receive an impetus, will be welcomed by the railway administration. The benefits that may be expected from it probably far outweigh the losses that may be suffered in some areas from the competition that will arise from road motor traffic ..... It is natural that in the replies received by the Committee from railways the latter should have expressed themselves as opposed to the construction of roads parallel to and running alongside the railway lines, but it must be recognised that a road system will have to be connected up and cannot be limited to roads more or less at right angles to railways. It is suggested, however, that there is large scope for many years to

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* Mr. T. K. T. Viraraghavachariar, District Board Engineer, West Godavari, Madras.

† Reply to the supplementary questionnaire submitted by the Bengal Nagpur Railway.

come in the development of roads which will feed the railways rather than compete with them, and that, even where roads are required parallel to the railways, they will open up the country better if built at some distance from the railways."

Interdependence of communications.

36. It is natural that each section of the community should emphasise the importance of the communications in which it is immediately interested. Thus the defect in existing communications that is most apparent to the agriculturist, is the condition of subsidiary roads connecting villages with main roads and with one another. On the other hand, the motorist and the promoter of motor transport sometimes do not see beyond the need for motorable roads. And the railway traffic officer may be primarily interested in 'radial' feeders. But the fact is that all communications are interdependent. The value of a village road is small unless it leads to a main road, which leads in turn to a market or railway. On the other hand, the full value of a railway is not realised, unless it is fed by an adequate system of main and subsidiary roads. The orderly development of all communications should proceed together. In particular, it is inevitable in a country so vast as India that the network of railways should have a very wide mesh. The intervals should be filled by roads, and it would appear that the development of railways has outstripped the development of roads. It is stated in the Railway Board memorandum that "railways in India have always felt the lack of roads to feed them". It is indeed somewhat incongruous that there should be nearly 40,000 miles of railway in India, while the total mileage of surfaced roads in British India is only 59,000.

Conclusion.

37. Our conclusion is that the development of the road system of India is desirable. It is especially desirable because it will make for the economic, social and political advancement of the rural population, on which the future of the nation so much depends.

CHAPTER V.

Road administration and finance in other countries.*

Comparison with other countries.

38. Before we examine the remaining questions referred to us, it will be useful to turn to the experience of other countries and consider the methods of road administration and finance which have been adopted to meet, in particular, the situation created by the rapid growth of motor transport in recent years. It should be clearly understood, however, that it would be unwise to press analogies with other countries in which the historical background, the existing constitution, the system of public finance, the taxable capacity of the people, and social and economic conditions generally may be widely different.

Great Britain.

Evolution of the present system.

39. The existing roads of Great Britain are the result of centuries of growth; and, without going back to the history of Roman roads, the evolution of the present system can be traced from parochial management by forced labour, through the toll and turnpike trust system and its failure, to the imposing of the whole burden upon the rate-payer, and the administration of roads by county councils, urban and rural district councils and other local bodies.† The growing sense of national responsibility for roads subsequently led to the enactment of the Development and Road Improvement Act of 1909. Under the provisions of this Act a Road Board, consisting of five members, was created in the following year, in which the administration of the road improvement grant was vested subject to the control of the Treasury. This grant comprised the proceeds, less the cost of collection, of the motor spirit duties and the motor licence duties imposed by the Finance Act of 1910, and sums once credited to it did not lapse if unspent. In its administration of this money the Board could borrow upon the security of the grant; it could make advances to highway authorities, in the form of grants or of loans, for the improvement of existing roads or for the construction of new roads, but not for ordinary repairs; while with respect to advances for the construction of new roads, it could not in any one year exceed one-third of its estimated receipts. The amount available for advances during the year 1911 appears to have been about one million sterling. The life of this arrangement was brief, for during the war it became impossible to continue these credits to the road improvement grant. After the war national participation in road administration and finance was consolidated and extended by the Roads Act of 1920; the powers previously vested in the Road Board were transferred to the Minister of Transport, and a Road Fund was

* We are indebted to our Technical Adviser for notes on the road systems of Great Britain and the United States of America. His note on the United States system has, by the courtesy of the Federal Government, been checked by Mr. H. S Fairbank, Highway Engineer, to whom our thanks are due.

† For a comprehensive review see English Local Government—The Story of the King's Highway, by S. and B. Webb.

created in which were merged the outstanding credits and liabilities of the road improvement grant. Under the Ministry of Transport Act the Minister was empowered to classify roads for the purpose of making advances from the Road Fund, while the previous prohibition of advances for repairs was not repeated. At the same time the method of taxation of motor transport was changed, a tax on motor vehicles, designed to produce an annual revenue of about seven million sterling, taking the place of the duty on motor spirit which was abolished. These various enactments may be said to mark the definite acceptance by Parliament of the principle that roads are of national importance and a fit object for expenditure from national revenues. It is true that, in the circumstances then prevailing, the necessary funds could only be realised by the taxation of motor transport, and the view was at that time widely held that such taxation should be regarded strictly as a temporary expedient in view of the need for heavy expenditure on roads at a time when the resources of the country were much depleted. This view, however, has not prevailed, and the capacity of motor transport to bear taxation is now generally recognised. Not only has taxation for road purposes been continued; but the balance at the credit of the Road Fund has, in time of financial difficulty, been appropriated to general revenues, while motor transport will be required in future to contribute to general revenues through the new import duty on motor spirit.

Classification of roads and contributions by the Ministry.

40. The road system thus evolved is complicated, but may in general be described as follows, though the summary does not cover every case. Prior to 1921 the roads of Great Britain were divided into two chief classes, 'main' and 'district', for which county councils and urban or rural district councils were respectively responsible. In 1921 roads were further classified as follows:—

Class 1—

(*a*) Main arteries connecting London with the principal towns and ports;

(*b*) Roads connecting towns of 10,000 population or more;

(*c*) Roads serving as connecting links between routes classified under (*a*) or (*b*);

(*d*) Roads connecting routes classified under (*a*) or (*b*) with large railway stations and other important places.

Class 2—

(*a*) Roads connecting urban areas of less than 10,000 population, or roads linking such areas with class 1 roads;

(*b*) Roads connecting congested rural areas with class 1 or other class 2 roads.

The classification of 1921 aimed primarily at determining the extent of contributions from the Road Fund, and did not replace the pre-existing administrative classification; it has, however, resulted in some modification of the latter, in that roads placed in classes 1 and 2 of 1921, that were not previously 'main' roads, are gradually being re-classed as 'main' and transferred to the charge of county councils. The Ministry contributes 50 per cent in the case of class 1, and $33\frac{1}{3}$ per cent in the case of class 2, of the cost of maintenance and of all approved projects of improvement. It may also make 'extra-classification'

grants for special purposes; actually, nearly half the contribution has in recent years taken the form of extra-classification grants. The roads department of the Ministry, in addition to the actual classification and its periodical modification, initiates schemes, approves projects, co-ordinates, stimulates and distributes the result of experiment and research, and supervises the road branch of the National Physical Laboratory. It may also, in certain cases, carry out the construction of new arterial roads direct. County councils usually manage their roads through roads or highways sub-committees, which supervise the County Surveyor who is chief executive officer.

Road Fund.

41. In the year 1920-21, £9,432,302 were credited to the Road Fund. In 1926-27 the amount was £18,232,948, of which £17,373,190 were from motor vehicle taxes. The payments from the Road Fund in this year were £24,613,320, including £7,000,000 appropriated to general revenues.

*France.**

Classification of roads.

42. "The national Service of Roads and Bridges, of France, was organized under an Order of Council dated February 16th, 1716, and by the middle of the eighteenth century there was in France a very extensive network of roads which had been built and maintained almost wholly from funds provided from the Royal Exchequer. The first Republic made provision for the maintenance of these roads from funds supplied by the national Treasury.

In 1797 these roads were divided into three classes as follows:

I. Roads leading from Paris to the frontiers.

II. Roads leading from frontier to frontier, but not passing through Paris.

III. Roads connecting towns.

Thus, as early as the end of the eighteenth century, France had a well-defined and classified system of roads and a system of technical control.

Napoleon I, in 1811, placed the cost of maintenance of Class III roads on the departments,† but the national Service of Roads and Bridges retained technical control.

Little change in the general plan of administration has taken place since 1811 so far as the national roads are concerned, but the development of other classes of roads has gradually been brought into harmony with that of the national roads.

At present the highways of France are comprised in four groups as follows:

I. National highways (*routes nationales*).

II. Provincial highways (*routes départementales*).

III. Main roads—county roads (*chemins des grandes communications*, and *chemins d'intérêt commun*).

* Extracted from Highway Administration and Finance, by Thomas R. Agg and John E. Brindley, pp. 96–98.

† A department in France is an administrative area or province.

IV. Local roads—township roads (*chemins vicinaux ordinaires*).

Roads of Class I are improved and maintained wholly at the expense of the national government and under the supervision of the national Service of Roads and Bridges.

Roads of Class II are improved and maintained at the expense of the department and the work is in charge of a departmental road service appointed by the departmental Commission.

Class III roads connect with the smaller cities and villages and are improved and maintained from funds of the communes, supplemented by grants from the department. They correspond somewhat to the state-aid roads of the United States.

Roads of Class IV are the responsibility of the commune, and the mayors of the towns are in charge of the care of the roads. The cost of maintenance is borne by the commune.

Thus, it will be seen that France has for many years possessed a classified system of highways with authority and responsibility assigned to the various political subdivisions of the government. She has long followed the policy of national financing and supervision of the main arterial highways. A policy closely akin to state aid has also been in operation for a long time. In fact, it is generally recognized that France has long enjoyed the benefits of a system of road management to which other nations must eventually turn.

Service des Ponts et Chaussées.

43. The most significant factor in the French organization is the long established national Service of Roads and Bridges (*Service des Ponts et Chaussées*) which has established a technical staff of commanding professional attainments. The system has been such that the principal members of the organization have had long-continued service in the Service, and the spirit of the whole staff is progressive and its work is based on the most painstaking consideration of all of the theoretical and practical factors involved in the French highway problem. The staff of the Service is made up of some of the outstanding highway experts of the world."

United States of America.

Evolution of the present system.

44. The evolution of the road system of the United States of America during the last 300 years followed in a great measure the same lines as in England. It began in Virginia with parochial responsibility and forced labour, passed through the stages of toll and turnpike trusts and companies to stagnation during the railway boom, after which the county emerges as the road authority. Later, in 1890, State Governments began to intervene, and various States created highway departments and commenced to contribute towards the cost of 'State aided' roads. Centralisation in the State increased and the State gradually assumed executive authority, till at the present day important roads are usually maintained and improved by the State direct, State aid having been replaced by State management. In certain cases the county now makes a contribution to the State in the place of its previous direct

expenditure on these roads, but as a general rule the tendency is all in the direction of complete financial responsibility and control by the State. Finally, by the Federal-Aid Road Act of 1916, which was afterwards amended by the Federal Highway Act of 1921*, the Federal Government associated itself with road development and began to contribute substantial sums. The chain of authorities now established is as follows :—

(1) Federal Government.—Department of Agriculture, Bureau of Public Roads, under the Secretary of Agriculture ;

(2) State Government.—State Highway Department, usually under a Commission or a Commissioner appointed by the Governor.

(3) County administration.

(4) Township administration.

The township is a rural area with its headquarter town or hamlet. Larger towns have, of course, separate urban administrations.

Federal-aid.

45. Appropriations for federal-aid are voted by Congress to be spent on construction or reconstruction, but not on maintenance. Each State is required to select or designate for federal-aid a system of highways not exceeding seven per cent of the total highway mileage of the State. The Secretary of Agriculture has authority to approve the systems as designated or to require modifications or revisions thereof. And all federal-aid apportionments are to be expended on these systems. The amount which may be contributed to any State in federal-aid is further limited by the amount which is apportioned to it out of the total federal appropriation. This apportionment is determined by section 21 of the Act of 1921 as follows :—

> " The Secretary of Agriculture, after making the deduction authorized by this section, shall apportion the remainder of the appropriation made for expenditure under the provision of the Act for the fiscal year among the several States in the following manner : One-third in the ratio which the area of each State bears to the total area of all the States ; one-third in the ratio which the population of each State bears to the total population of all the States, as shown by the latest available Federal census ; one-third in the ratio which the mileage of.....routes in each State bears to the total mileage of. .....routes in all the States at the close of the next preceding fiscal year .....*Provided,* That no State shall receive less than one-half of 1 per centum of each year's allotment. All moneys herein or hereafter appropriated for expenditure under the provisions of this Act shall be available until the close of the second succeeding fiscal year for which apportionment was made ..... *And provided further,* That any amount apportioned under the provisions of this Act unexpended at the end of the period during which it is available for expenditure under the terms of this section shall be reapportioned within sixty days thereafter to all the States in the same man-

* See Appendix V.

ner and on the same basis.....as if it were being apportioned under this Act for the first time."

Within the amount so apportioned to it, each State may receive federal-aid for projects approved by the Secretary of Agriculture, up to a maximum of 50 per cent of the total cost. In approving projects, the Secretary of Agriculture is required to give preference to such projects as will expedite the completion of an adequate and connected system of highways, interstate in character. The 50 per cent maximum is not paid in all cases. This is partly due to the statutory limit of $ 15,000 per mile beyond which federal-aid is not admissible, and partly to the fact that the States have not applied for the full 50 per cent in all cases. Up to the end of 1926, some 56,700 miles of federal-aid roads had been so constructed. The total cost of these had been $1,051,450,000, of which some $466,030,000 or 45 per cent had been contributed as federal-aid. The average cost per mile had been $19,951.

Classification of roads and mileage.

46. Roads which may receive federal-aid are divided into two classes, namely, primary or interstate highways and secondary or intercounty highways. The former may not exceed three-sevenths of the total federal-aid mileage, and may not receive more than 60 per cent of all federal-aid until provision has been made for the improvement of the entire system. Certain roads have also been classified as United States highways, primarily for the purpose of uniform sign-posting and marking in the interests of through traffic; but this does not affect their administrative classification, and they are included in the federal-aid system of each State. Thus the roads of the United States may be divided into the following classes:—

(1) Federal-aid roads, namely,
  (*a*) primary or interstate highways, and
  (*b*) secondary or intercounty highways;
(2) State roads;
(3) County roads;
(4) Local roads.

The latest complete figures of mileage that are available, are for the year 1925. The total length of all roads was then three million miles. Of this total, six per cent were federal-aid roads, compared with the seven per cent permissible; nine per cent were roads maintained by the States; and excluding the surface known as sand-clay, some fifteen per cent were surfaced.

Bureau of Public Roads.

47. Federal administration, under the Secretary of Agriculture, is centred in the Bureau of Public Roads. In addition to approving projects for federal-aid and generally administering this money, the Bureau initiates, co-ordinates, subsidises, and carries out direct or conjointly with the highway departments of States, every kind of investigation and research, technical or economic, that may have a bearing on the use and development of roads; it also carries out independent investigations and enquiries into any matter upon which a State may desire a second opinion; and it publishes the results of investigations and other information monthly in 'Public Roads'.

*Canada.**

48. "It is interesting to note that up to the present time the cost of road improvements in Canada has been met by current funds, and recent proposals for the issuance of debentures for highway improvement have met with general opposition.

Evolution of the present system.

In the period prior to the Confederation of the Canadian provinces, which occurred in 1871, highway development in Canada was exceedingly slow, the waterways being utilized almost exclusively for intercourse between the various parts of the vast domain. The small amount of road work actually carried out in that period was wholly by local initiative or for military purposes and was usually supervised by the Royal Engineers. Labor was supplied by the settlers in lieu of a road tax.

In the period from 1871 to 1919, Canada was growing into a unified nation and was being settled and developed. In this period each province was a unit of road administration and the county and township were subunits. Toward the end of this period, the provinces aided the counties and towns with grants of funds for road improvements in amounts varying from one-fourth to one-third the cost of the work. By the end of the period each province had a more or less stable department of public works, or an organization corresponding thereto, and some classification of highways by which the responsibility of the province, the county, and the township was definitely established with reference to certain parts of the road system of the province.

49. In 1919 the Canadian Highways Act of the Canadian Parliament became a law and ushered in a new era in the development of the highways of the Dominion. The Act provided for the classification of the highways of the Dominion and the granting of federal aid to a limited system of national roads. The sum of $20,000,000 was provided by Parliament to be allotted to the provinces on the following basis:

Canadian Highways Act.

1. To each province, $80,000 (a total of $720,000) each year for 5 years.
2. The remainder of the $20,000,000 appropriation to be distributed to the provinces on a basis of population.

It was further provided that the allotments must be secured through the adoption of construction projects approved by the Canadian Highways Commission, and that the federal allotment must not exceed 40 per cent of the total cost of the work.

It was originally planned that all construction provided for under the Canadian Highways Act should be completed in 5 years, but that period was later extended 2 years.

Under the provisions of the Highways Act, there was established a system of Canadian National Highways comprising some 25,000 miles well distributed throughout the Dominion and about 3,000 miles of this system were improved in a manner suitable for the traffic. The operation of the Act has also served

*Extracted from Highway Administration and Finance, by Thomas R. Agg and John E. Brindley, pp. 88-89.

to strengthen the Provincial highway departments and to stimulate greatly general interest in road improvement."

*New Zealand.**

Road administration.

50. "The control of roads and bridges in New Zealand comes under the administration of the Minister of Public Works, the main statutes covering roads administration being the Public Works Act of 1908 and its amendments and the Counties Act, 1920, and amendments.

Outside of the cities, boroughs, and independent town districts, the local administration is very largely vested in County Councils, and all roads, unless specially exempted and declared Government roads, are controlled by the County Councils. Local authorities have the assistance and advice of the Public Works Department through its various engineers stationed in most of the main centres.

The allocation and legalization of roads is arranged by the local authorities and the Public Works Department conjointly.

The Government assists materially towards the construction of roads and bridges, and grants and subsidies are given to the County Councils according to the particular circumstances of each individual case. The county quota of the cost is usually found by raising loans secured by a special rate levied over the area to be served by the road.....

Maintenance of roads is administered almost entirely by local authorities, the necessary funds being obtained from general rating, but in cases of exceptional circumstances such as those of roads of considerable length in sparsely populated districts where the local rate is totally inadequate to cover efficient maintenance, the Government grants assistance by way of subsidies from the Consolidated Fund.

Since the advent of modern fast and heavy motor traffic efficient maintenance of roads is becoming increasingly important, and, with a view to protecting the capital expenditure on roads, no opportunity is lost by the Public Works Department of impressing on local bodies their responsibility in this direction. Some few years ago the Public Works Department instituted a policy of obtaining from local authorities, before issuing any assistance for metalling work, a definite assurance that the Council was in aposition and prepared to annually allot from its Revenue Fund sufficient money to efficiently maintain the metal when placed.....

Main Highways Act.

51. It was found in New Zealand, as in other parts of the world, that under the strain of motor-traffic the roads were deteriorating, while the popular clamour that they be improved to meet modern conditions was insistent. This led in 1921 to the introduction of a Main Highways Bill, which provided that all works of construction and maintenance on certain specified highways were to be carried out by the Government without any contribution from local authorities.

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*Extracted from New Zealand Official Year-Book, 1928, pp. 388—392.

The mileage then proposed was about 2,000 miles, but the Bill provided that this could be extended from time to time.

It was contended, however, by the local authorities that the creation of these main highways under direct Government operation would lead to dual control and overlapping supervision, and also that it was undesirable to deprive the local authorities of all powers over roads within the areas under their jurisdiction. Further, it was claimed that the scheme, by not covering a sufficient length of roads, did not give adequate relief to the local authorities. .....For these reasons this Bill did not become law; but in 1922 a modified Bill again came before Parliament, and was finally passed as the Main Highways Act, 1922. The Act of 1922 has since been amended in several respects.

For the purposes of the Act a Board called the 'Main Highways Board' was set up. The Main Highways Board consists of the Engineer-in-Chief and Under-Secretary of the Public Works Department (Chairman); the Assistant Engineer-in-Chief and the Chief Clerk of the Public Works Department; two representatives of County Councils; and one representative of owners of motor vehicles.

52. The Dominion has been divided into eighteen highway districts, which are composed of groups of counties, suitable, by geographical situation and community of interest, for so being grouped.....

Highway districts.

District Highway Councils are set up in each highway district, these Councils being constituted to include a Public Works Engineer, and one person to represent each constituent county, with an executive of three to be appointed by the members of the Council.

The functions of the District Highway Councils are to make recommendations for each year as to which roads within the several districts should be declared main highways, and what works should be done and what expenditure incurred on these highways during that period.

The District Highway Councils are guided by the following considerations when recommending roads for declaration as main highways:—

As to whether the roads may be regarded as arterial in that they carry appreciable volumes of through as well as local traffic:

As to whether the roads connect large centres of population within the highway district:

As to whether the roads carry appreciable traffic to and from seaports or railway centres within or without the highway districts.....

53. Under the Act of 1922 it was provided that the Main Highways Board should pay one-half of the cost of construction or reconstruction of main highways and one-third of the cost of maintenance or repair. The Main Highways Amendment Act, 1925, however, authorized the Board to increase its subsidy on the cost of maintenance on ordinary main highways from one-third to one-half, retrospective to the 1st April, 1925, while an amending Act passed in 1926 authorized a still further increase to three-fifths. It is made clear to local

Subsidies.

authorities that it is not the intention, by giving a more liberal subsidy, to relieve them of liability in respect to maintenance, the additional subsidy being for the purpose of meeting the additional cost of maintenance brought about by the increased motor traffic.....

54. The Main Highways Account is subdivided as under :—

Finance.*

(*a*) Revenue Fund, which includes an annual transfer from the Consolidated Fund of at least £35,000; proceeds of tax on tires and tubes, as collected through the Customs Department; registration and license fees of motor-vehicles.

(*b*) Construction Fund, which includes a transfer from the Public Works Fund, not less in any year than £200,000, together with all moneys borrowed by the Minister of Finance as may be required for purposes of construction and reconstruction, to a limit of £3,000,000. This sum is intended to extend over a period of ten years.....

The estimates of amounts required for maintenance and repairs, construction and reconstruction, and all other items are forwarded by the District Highway Councils, and after review by the Board are incorporated in the Estimates, which in turn are submitted for approval to Parliament, for inclusion in the annual appropriations.

The revenue from the licensing of motor-vehicles and from taxes on tyres and tubes is apportioned between the North and South Islands in the discretion of the Board, but generally so that the amount apportioned to either Island is fixed by reference to the number of motor-vehicles in that Island."

China.†

National good roads movement.

55. " In ancient China, roads were built for military purposes. Later on, the road system was maintained for communications between the Central Government and Provincial Governments for political purposes. At the end of the Manchu dynasty (1911) we possessed 2,000 miles of Imperial roads, radiating from Peking to connect with all provincial capitals. Recently we came to realise that communication is the forerunner of political, financial and industrial progress. To help agriculture and industrial development by means of communications is a national slogan. A national good roads movement of China was launched in 1921. The Association for that purpose was set up in Shanghai, its object, independent of parties and Government, being to advocate the building of good roads throughout China. A very well elaborated plan of road building, which classifies the projected roads into national, provincial, and district, was drawn up, and was to be carried out either by national and local Governments or by the people themselves."

*By resolution of the House of Representatives on 31st October, 1927, a tax of 4*d.* per gallon is placed on petrol. The proceeds of this tax will be utilized partly for main highways and partly for roads and streets outside the main highways scheme.

† From a paper submitted by Tsooming Chiu, on behalf of the Chinese Ministry of Communications, to the World Motor Transport Congress. 1927.

Summary.

56. In their recent work on Highway Administration and Finance, from which we have already quoted in this Chapter, Messrs. Agg and Brindley have thus stated their conclusions* :—

"These selected examples of highway systems of other lands illustrate the tenacity with which the local authorities cling to their authority in road matters and undoubtedly show that the local unit of government has a place in a system of highway administration. With the ever-changing modes of transportation, however, modifications of old systems have become imperative and these new developments present a striking similarity wherever noted.

These extracts also show how the need for technical supervision of certain classes of road work has forced itself upon public consciousness among all nations.

The outstanding impression resulting from a perusal of these outlines of highway administration in many lands might be summarized as follows :

1. The principle of classification of highways according to importance seems to be recognized generally as an administrative and constructive necessity.
2. Some form of national supervisory body aids in the correlation of the highway work of the various subordinate governmental units and is deemed of sufficient importance that nearly every nation has adopted the principle.
3. The construction of high-type highways involves materials and methods of such a character that technical supervision is deemed a prerequisite to adequate highway development.
4. The inequity of causing the smaller units of government to bear all of the cost of main-road improvements seems to be recognized all over the world. The principles of what is known in the United States as state and county aid have been adopted almost universally."

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* Highway Administration and Finance, by Thomas R. Agg and John E. Brindley, pp. 106-107.

CHAPTER VI.

The means by which road development in India could most suitably be financed.

Interest of the Government of India in road development.

57. Without stressing unduly the experience of other countries, we think it follows from our account of conditions in India that road development here, as elsewhere, is now passing beyond the financial capacity of local Governments and local bodies, and is becoming a national interest which may, to some extent, be a proper charge on central revenues. The interest of the Government of India is peculiarly strong, for, as we have shown, railways, which are a central subject, and the development of roads are interdependent. At the same time, central revenues benefit from road development, not only through enhanced railway receipts, but also through the customs and excise receipts from motors and motor spirit, which are rapidly expanding. Provincial revenues and local funds, on which practically the whole burden of road construction and maintenance now falls, are less directly affected. Further, the duty on motor spirit, which has been recommended to us, almost unanimously, as the most equitable method of taxing motor transport for road development, is a source of central revenue.

The constitutional position.

58. Roads, however, have been classified as a provincial subject under the Devolution Rules made under the Government of India Act, and in all Governors' provinces except Assam they are also a transferred subject. The Act provides that no measure regulating a provincial subject shall be introduced in the Indian legislature without the previous sanction of the Governor General; and the Devolution Rules further provide that the powers of superintendence, direction and control over local Governments vested in the Governor General in Council under the Act shall, in relation to transferred subjects, be exercised only for certain limited purposes, namely to safeguard the administration of central subjects, to decide questions arising between two provinces, and to safeguard the due exercise and performance of certain powers and duties. We understand that it has also been held that payments from central revenues in aid of provincial subjects, unless specifically provided for and legally controlled, are inconsistent with the principles underlying the scheme of the Government of India Act. It follows that, as the Devolution Rules now stand, the interest of the Government of India in road development can have no effective expression. We assume, however, that the appointment of a Committee of the Indian legislature to consider the question of road development, the terms of reference, and the participation of local Governments in our proceedings, may be taken to indicate that our recommendations need not be restricted by the present terms of the Devolution Rules, which will be amended as may be found necessary.

The finance of road development. (1) From general revenues.

59. All expenditure on roads is now met from general revenues. No special taxation, either central or provincial or local, is levied for expenditure on roads. And it appears to us that road development,

in so far as it contributes to the general welfare of the country as a whole, is a proper charge on general revenues. It must be recognised, however, that no large increase in expenditure from general revenues appears to be practicable at present. It is the common view of local Governments and local bodies that they are already spending on roads as large a proportion of their general revenues as they can afford, and that they are unable to increase the proportion without detriment to other nation-building activities, such as education and public health. At the same time, their sources of revenue do not appear at present to be capable of any large expansion. On the other hand, sources of central revenue are more elastic; and in particular, expenditure on road development tends to increase receipts from certain sources and, to this extent, might perhaps be regarded as remunerative. We are not, however, prepared to recommend that road development should be financed from the existing revenues of the Government of India, for we are not in a position to assess conflicting claims for expenditure on other objects, or for the reduction of taxation.

(2) From additional taxation on motor transport.

60. Though expenditure on roads is ordinarily a proper charge on general revenues, the fact remains that the growth of motor transport has created additional demands and requirements. And it does not seem to be unreasonable that these additional requirements should be met, to some extent at any rate, by additional taxation on motor transport. The evidence that has been given before us goes to show that additional taxation for this purpose would not be opposed by the interests affected, provided that they were assured that the receipts would be spent on the requirements of motor transport, and would not be diverted to other objects. The reasons for this acquiescence are intelligible. Not only would such expenditure improve and extend the facilities for motor transport, but it would also substantially reduce the running costs. The effect of road surfaces on running costs is not perhaps fully realised. No accurate figures appear to have been calculated in India. But the following extract from an American bulletin* may be taken as a basis of comparison :—

Road surface.	Cost of running per mile for a motor car travelling at 25-35 miles per hour. As.	P.†
1. Best Portland cement concrete and asphalt filled brick ..	4	8
2. Best gravel, yearly average	5	5
3. Ordinary gravel, yearly average	5	11
4. Water-bound macadam, well maintained	5	7
5. Bituminous macadam, well maintained	5	4
6. Average sheet asphalt	5	0
7. Best earth well packed by traffic, yearly average	6	0
8. Ordinary earth with light traffic, yearly average	6	4

*Bulletin 69 Iowa State College, quoted in Facts and Figures of the Automobile Industry, 1927.

† Cents reduced to annas and pies at the rate of 1 cent = 6 pies.

These figures, which allow for depreciation, repairs and wear and tear of tyres, as well as for the consumption of petrol and oil, cannot be applied to India without many reservations ; but the difference in the cost of running over good and over bad roads in India is possibly not less than is represented by them. If they are taken as they stand, it appears that the cost of running a car for twenty miles over a bad unmetalled road is two rupees more than the cost of running over a first class surface. In other words, the additional wear and tear of bad roads are more than the whole cost of the petrol consumed on an equal journey on a first class road. In any case, if the figures are at all reliable, it follows that the saving in running costs from improved surfaces should more than offset any additional taxation on motor transport that is likely to be contemplated.

Present taxation on motor transport. (1) Central.

61. The possibility of additional taxation on motor transport cannot, however, be considered without reference to existing taxation for general revenues. It would be unwise to discourage by excessive taxation the growth of a new and valuable transport service ; and at the same time, there is the danger that additional taxation, by bringing into operation the law of diminishing returns, might affect the amount realised for general revenues. The progress of central taxation on motor transport is summarised in Statement N of Appendix III. Briefly the total receipts from central taxation, that is, from customs and excise, have risen from Rs. 9 lakhs in 1913-14 to Rs. 2,71 lakhs in 1927-28. The rates of duty have been enhanced as follows :—

	1913-14.	1927-28.
	Customs (import tariff).	
	Ad valorem.	*Ad valorem.*
Motor cars and cycles, parts and accessories	5 per cent ..	20 per cent
Motor omnibuses, lorries and vans, parts and accessories	5 per cent ..	15 per cent
Rubber tyres and tubes	5 per cent ..	15 per cent
	Per gallon.	*Per gallon.*
Motor spirit*	1½ annas ..	4 annas
	Excise.	
Motor spirit	Nil	4 annas

Substantial reductions in the rates of duty have, however, been made in recent years. In 1925-26, the import duty on motor spirit was reduced from 8½ annas per gallon to 4 annas, and the excise duty from 6 annas to 4 annas. And in 1927-28 the import duty on motor cars and cycles, parts and accessories was reduced from 30 per cent ad valorem to 20 per cent, and on pneumatic tyres and tubes from 30 per cent to 15 per cent.

(2) Provincial.

62. When proposing these reductions of import duty in 1927-28, in his budget speech in the Legislative Assembly, the Honourable the Finance Member said :—

> " Neither the Government nor, I think, the House would feel perturbed if the Provincial Governments seized the opportunity of this reduction of the import duty to impose provincial taxation on the users of motor cars for the improvement and development of their systems of road communication. "

* Imports of motor spirit have hitherto been negligible.

Hitherto, however, no local Government has responded to this suggestion, not, we understand, because such taxation is considered to be objectionable, but only because the report of this Committee is awaited. The only province in which there is now any provincial taxation on motor transport is the Punjab, where a provincial vehicle tax was first imposed in 1924. The tax is calculated according to seating capacity for passenger vehicles, and according to weight for goods vehicles. There is an elaborate schedule of rates ranging from Rs. 25 to Rs. 700 per annum, and falling somewhat more lightly on commercial than on private vehicles. Total receipts from this tax in 1926-27 were less than Rs. 3 lakhs. In the United Provinces, a provincial tax on motor vehicles, which yielded Rs. 2 lakhs, was imposed in 1923, but was withdrawn in the following year. It should be added that in provinces where there are road tolls, tolls paid on provincial roads are credited to provincial revenues, but the amount so realised from motor vehicles cannot be separately stated.

The fee for registration under the Indian Motor Vehicles Act (VIII of 1914) is payable to the local Government of the province in which the vehicle is registered. The fee is intended only to cover the cost of administration and varies from province to province. The usual fee for first registration is Rs. 16, and Rs. 32 for heavy vehicles. In the provinces where annual re-registration is required, the renewal fee is considerably less than the original fee. The fee for a driver's licence under the same Act is also payable to the local Government.

63. The local taxes levied on motortransport include :—

(3) Local.

(*a*) Octroi and terminal taxes ;

(*b*) Vehicle and wheel taxes ;

(*c*) Licence fees for vehicles plying for hire ; and

(*d*) Tolls.

Local taxation varies greatly in different localities. Except in the Madras Presidency and in the cities of Calcutta and Bombay and one or two large municipalities in the United Provinces, local taxation is usually unimportant.

In the Madras Presidency substantial taxes are imposed both by municipal bodies and by district boards. Vehicle taxes in municipalities vary from Rs. 50 to Rs.70 per annum on private cars, and from Rs. 200 to Rs. 400 on commercial vehicles. The licence fee for a public vehicle levied by a district board may be as much as Rs. 1,000 per annum. In addition, there are toll bars at intervals of about ten miles on the main roads, at each of which a motor vehicle is usually required to pay a toll of one rupee. The total revenue realised from taxation on motor transport by local bodies in Madras, in the year 1926-27, was approximately :—

	Rs. lakhs.
Vehicle tax	.. 9·25
Licence fees for public vehicles..	.. 7·00
Tolls	.. 11·00
Total	.. 27·25

It should be remarked that the mileage of surfaced roads maintained by local bodies in Madras is considerably more than in other provinces. On the

other hand, there is general complaint that tolls are harassing and should be replaced by some other form of taxation.

In the city of Calcutta there is a carriage tax on all private cars, motor buses, taxis, and motor cycles, which varies from Rs. 36 to Rs. 60 per annum according to the number of wheels and the superficial area, and also a cart tax of Rs. 20 on all commercial goods vehicles plus Rs. 5 per ton of the full carrying capacity. Receipts in 1925-26 amounted to Rs. 2·86 lakhs.

In the city of Bombay, there is a vehicle tax on vehicles 'impelled by machinery', which ranges from Rs. 60 to Rs. 160 per annum for four-wheeled vehicles used solely for carrying passengers, and from Rs. 120 to Rs. 240 for vehicles used for commercial purposes other than the carriage of passengers. The average annual receipts for the three years ending 1926-27 were Rs. 5·35 lakhs. The condition of the roads in the city of Bombay appears to give general satisfaction, and there were no complaints that the taxation on motor vehicles was excessive in view of the road service provided. The total expenditure by the Corporation on roads is stated to be about Rs. 25 lakhs per annum.

Taxable capacity of motor transport.

64. It is not possible to calculate the average incidence of all existing taxation on motor transport with any accuracy from the data available. Nor would anything be gained from comparisons with the average incidence in other countries, in which conditions may be altogether different. There seems no reason, however, to suppose that taxation on motor transport in India has reached its economic limit. The import duties now are not high for a tariff in which the general rate of duty is 15 per cent *ad valorem*. Substantial reductions have recently been made, and even before these reductions imports continued steadily to increase. The figures in Statement L of Appendix III suggest that the prices of imports have now been stabilised at a considerably lower figure than the prices of a few years ago. In particular, the average value of motor omnibuses, vans, and lorries imported without bodies in 1927-28 was only Rs. 1,649. Similarly, there has been a reduction of the duty on motor spirit accompanied, as will be seen from Statement M of Appendix III, by a heavy fall in price. The main port price of petrol is now 12½ annas per gallon less than it was five years ago, and there has been a fall of 3 annas per gallon in the last year. In addition there have been reductions of the railway freight on motor spirit, with effect from 1st June last, amounting to a further reduction of about 2 annas per gallon in prices at the more distant inland towns. The figures in Statement M of Appendix III show a rapid increase in the consumption of petrol during the last three years. It has not been shown in evidence that the present rate of taxation has retarded the development of motor transport. The argument has rather been that any tax on transport is economically unsound, but that an even higher scale of taxation would be not unacceptable, provided that it was regarded as taxation *for* transport rather than *on* transport, and that the receipts were spent solely on road development. It is unnecessary for us to discuss this contention at any length. Whatever theories may be held, it is a fact that the present financial system in India requires various forms of transport to contribute to general revenues, and the exemption of motor transport would not be a practical proposal. Our

conclusion is that some additional taxation might be imposed on motor transport for purposes of road development, over and above the existing taxation for general revenues.

Proposals for additional taxation on motor transport.

65. It has been seen that motor transport is now taxed in the following ways :—

(1) Import duties on motor vehicles, parts and accessories, and tyres and tubes ;

(2) Import and excise duties on motor spirit ;

(3) Octroi and terminal taxes ;

(4) Vehicle taxes ;

(5) Licence fees for vehicles plying for hire ;

(6) Tolls ;

(7) Fees for registration and for drivers' licences.

It has not been suggested in evidence that any additional import duty should be imposed on motor vehicles, parts and accessories ; and an additional import duty on tyres and tubes, though suggested by one witness, would not be generally acceptable. High octroi and terminal taxes are generally considered to be objectionable. Tolls are condemned and should be abolished rather than enhanced. Fees for registration and for drivers' licences should only cover the cost of administration. In the absence of any new method of taxation,—and none has been suggested to us,—there remain only the duty on motor spirit, vehicle taxes and licence fees for vehicles plying for hire. It has been proposed by some that any additional taxation should be concentrated in a single tax on petrol which, it is claimed, is the most equitable means of taxing road users according to the use made of the road. But the case for a single tax on petrol is not convincing. In the first place, the equity of a petrol duty alone is by no means absolute. Secondly, heavy taxation of petrol would tend to stimulate the use of petrol substitutes and of other motive powers which might not be so easily taxed. There are also other advantages in spreading taxation rather than concentrating it on a single commodity. In our opinion, therefore, a well-balanced scheme of additional taxation on motor transport for purposes of road development should include vehicle taxation as well as petrol duty, and should possibly also extend, at any rate in some areas, to licence fees for vehicles plying for hire.

Duty on motor spirit.

66. It is difficult to arrive by argument at the precise rate of duty which it would be fair and prudent to impose on motor spirit. It may be argued, on the one hand, that the cost of petrol is such a small item in the total running costs of a motor vehicle that variations in price are scarcely felt ; and in support of this view it may be urged that the higher price of petrol in inland towns, which even after the recent reductions of railway freights may be as much as 6 annas per gallon more than at main ports, does not appear to have affected the development of motor transport. It is also true that for a motor car running twenty miles to a gallon, a duty of 4 annas per gallon adds only one-fifth of an anna to the total running costs per mile, which are probably about 6 annas. On the other hand, it is a fact that the duty of 6 annas per gallon was originally imposed

in 1917 as a war measure to check consumption. It is a fact that the duty was reduced to 4 annas in 1925 in the expectation that there would be a compensating increase in consumption. It is a fact that the progressive reductions in the price of petrol since 1924-25 have coincided with a period of rapidly increasing consumption. And finally, the recent reduction of railway freights was expected to stimulate consumption, and might be neutralised by an enhancement of duty which would merely transfer the consumer's payments from the railway budget to the general budget. The truth is that it is impossible to forecast with precision the effects of any taxation, for the factors are psychological as well as economic. After full consideration, however, we are of opinion that the duty on motor spirit might be raised again to 6 annas per gallon without affecting consumption, provided that the additional 2 annas now imposed is spent on road development which, if the figures given in paragraph 60 are to be trusted, may be expected to react sharply on petrol consumption. The amount realised from this additional duty on motor spirit would be Rs. 62 lakhs on the figures of 1927-28 ; and it may be objected that this will not go far to finance road development throughout India. It is enough, however, at this stage to make a beginning. It has been seen that the duty on motor spirit is a rapidly expanding source of revenue, and that the consumption of petrol has been increasing annually at the rate of about 30 per cent compound interest. The rate of increase should be sustained as motor transport continues to develop and the range of movement is extended by a better road system. Further, if the time arrives when it is possible to abolish or reduce taxation on motor spirit for general revenues, we are of opinion that the Government of India should consider the desirability of retaining the tax for purposes of road development.

Reduction in price of petrol.

67. We make this recommendation subject to one qualification. It has been brought to our notice that railway freights account for only a part of the difference between the retail price of petrol at main ports and in inland towns, and that a substantial balance represents the " selling charges " exacted by the oil companies. The figures given below as instances are for last April, before the reduced railway freights had come into force ; but the revised prices that have recently been introduced by the oil companies apparently do no more than pass on to the consumer the reduction in railway freights, and have not touched, except for " rounding ", their own selling charges.

Retail prices of petrol in bulk in April 1928.

Port. 1	Sale price at port. 2	Destination. 3	Railway freight per gallon. 4	Total of cols. 2 & 4. 5	Sale price at destination. 6	Difference between cols. 5 & 6. 7
	Rs. A. P.		Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Calcutta .	1 0 6	Nagpur .	0 3 7	1 4 1	1 8 0	0 3 11
Calcutta .	1 0 6	Delhi .	0 5 3	1 5 9	1 8 6	0 2 9
Bombay .	1 0 6	Jubbulpore .	0 5 3	1 5 9	1 9 0	0 3 3
Bombay .	1 0 6	Poona .	0 0 10	1 1 4	1 3 0	0 1 8
Madras .	1 0 6	Bangalore .	0 1 6	1 2 0	1 4 0	0 2 0
Karachi .	1 0 6	Lahore .	0 4 9	1 5 3	1 8 6	0 3 3

Note.—The freight on petrol for long distances was reduced from the 1st June 1928.

It should be understood that the port prices are retail prices and, therefore, include selling charges at the ports. The figures in column 7 thus represent a surcharge to cover the cost of distribution in inland towns, over and above the amount already added for the cost of distribution at the ports. It is intelligible that the cost of distribution, allowances for wastage, handling and so on, should be more in inland towns than at the ports. But it is not apparent why at Nagpur, for instance, the selling charges should exceed the freight from Calcutta or should be $2\frac{1}{4}$ annas per gallon more than the selling charges at Poona. We appreciate that large capital expenditure is being incurred in installing bulk distribution. But with increased consumption, overhead charges would have a wider spread, and the selling charge per gallon might correspondingly be reduced. The recent reduction in railway freights anticipated a compensating increase in consumption, but it would have been more effective if it had been accompanied by a reduction in the oil companies' selling charges. We suggest that an effort should now be made to induce the oil companies to co-operate with the railway administration in reducing the retail price of petrol in inland towns.

Objections to duty on motor spirit. (1) Use of motor spirit for other purposes.

68. There are, however, objections to a duty on motor spirit for purposes of road development. In the first place, it is objected that motor spirit is used for other purposes besides road transport, and in particular for agricultural tractors and other machinery, for motor boats and for aviation. We have been informed, however, that the use of motor spirit for agricultural tractors and motor boats is almost negligible, normally being required only for starting the engine which is then run on crude oil or kerosene. The case of aviation is more difficult, but has not yet become a live issue. It is sufficient now to note that aviation spirit is easily distinguishable from motor spirit and, being more expensive, could probably be exempted from all or part of a moderate duty on motor spirit without inconvenient consequences. Secondly, it is understood that a successful system of aviation is itself partly dependent on an adequate road system.

(2) Burden on large towns.

69. It has also been objected that a great part of a duty on motor spirit will be paid by motor transport in large towns, and that the receipts will be spent on extra-municipal roads from which the towns derive no direct benefit. Objections of this nature are perhaps an inevitable incident of ad hoc taxation, and may be a reason why such taxation should be avoided. But in this case, it is not difficult to show that the complaint is over-stated. It may be assumed that part of the proceeds of the duty will be spent on main roads leading into large towns, and on the improvement of their approaches generally. It should be obvious that the improvement of communications between a town and the surrounding country would not only benefit the country, but also bring reciprocal advantages to the town. It would be as easy to maintain that local bodies in the vicinity of a large town are required to incur heavy expenditure on roads for the benefit of motor traffic from the town which they are unable to tax. It has been stated in evidence before us that the advantages resulting from this improvement of communications may not be fully shared by cities like Bombay. We are convinced, however, that such cases are not incapable of being adjusted by some suitable arrangements with the local Governments.

Duty on motor spirit a source of central revenue.

70. The existing duty on motor spirit is a source of central revenue, and it seems clear that any additional taxation on motor spirit for purposes of road development must also be central. It has indeed frequently been suggested that a provincial surtax should be permitted, which should be collected either direct by the local Government from licensed vendors within the province, or through the agency of the Government of India from the oil companies, along with the central duty as "centimes additionnels", calculated according to the consumption in the province shown in the companies' books. But a provincial surtax, however collected, is open to strong objection. In the first place, it is desirable that sources of central and provincial revenue should remain as far as possible distinct. It would lead to obvious inconvenience and conflict of interest if the central and provincial Governments were to encroach upon each other's fields of taxation. Secondly, it seems essential that the duty on motor spirit should be uniform throughout India. It would be administratively impossible to prevent import from low duty areas into high duty areas. But the difficulties of imposing simultaneously a uniform surtax not only in all provinces, but also in all Indian States, may be regarded as practically insuperable. It has been suggested as an alternative that the excise duty on motor spirit should be made altogether a source of provincial revenue. But apart from any difficulty that the Government of India might feel in surrendering the proceeds of the existing duty, the need for a uniform rate of duty throughout India would still remain ; and in addition there would be the possibility of conflict with the customs duty on imported motor spirit which, though negligible now, may become more important in the future. It seems likely that the demand for provincial taxation on motor spirit is based on the hypothesis that the proceeds of a source of central revenue cannot be spent on roads, which are a provincial subject. But when once it is conceded that central revenues may properly contribute to road development, the demand loses much of its force.

Grants from central revenues for road development. Proposed convention.

71. It should be realised, however, that grants from central revenues for road development can only be made through the constitutional processes prescribed by the Government of India Act. That is, the estimated annual expenditure and revenue must be laid in the form of a statement before both chambers of the Indian legislature in each year ; and proposals for the appropriation of revenue must be submitted to the vote of the Legislative Assembly in the form of demands for grants. On the other hand, it is desirable that local Governments which are responsible for the administration of roads within their respective provinces, should know in advance what grants they may expect and should not be altogether dependent on the annual vote of the Legislative Assembly. A road programme should be planned for a period of years, and grants cannot be utilised effectively unless some continuity is assured. We suggest, therefore, that a convention should be establishd whereby the Legislative Assembly would annually vote the proceeds of the additional duty on motor spirit which we have proposed, as a block grant for expenditure on road development. This annual grant should be credited to a separate road development account, and it should be arranged that unexpended balances should not lapse at the end of the financial year, but should be carried over or re-voted for expenditure in the follow-

ing year. We suggest that this convention should be established in the first instance for a period of five years, after which the position should be reconsidered.

Control over expenditure.

72. If grants were considered to be maladministered or mis-spent, the Assembly would be able in the last resort to withdraw from the convention and refuse the demand for grant in the following year. But we also propose that the Assembly should continue to exercise control over the detailed expenditure of the annual grant in two ways. Firstly, the general principles in accordance with which the grant should be spent, should be approved by the Assembly. Secondly, we recommend the appointment of a Standing Committee of the Indian legislature for Roads, similar in constitution and functions to other departmental Standing Committees, which would advise the Governor General in Council on all matters relating to roads; and we further recommend that there should be a Finance sub-committee consisting of members of the Assembly, and that no expenditure from the annual grant should be incurred without its approval.

The federal-aid system in the United States.

73. In formulating principles for the expenditure of the annual grant, we have considered the principles adopted in other countries, as described in Chapter V, and in particular the system of federal-aid in the United States of America. In the United States, it will be remembered, the annual appropriation for federal-aid is apportioned among the States according to a fixed formula. Within the amount so apportioned each State may receive federal-aid, up to a maximum of 50 per cent of the total cost, for projects approved by the Secretary of Agriculture. Projects must relate to roads included in a system of highways previously designated by the State, with the approval of the Secretary of Agriculture; and the Secretary of Agriculture is also required to give preference to such projects as will expedite the completion of an adequate and connected system of highways, interstate in character. Finally, if any part of the appropriation apportioned to a State remains unexpended at the end of the fiscal year, it is available for expenditure in that State until the close of the second succeeding fiscal year, after which it is re-apportioned among all the States.

Principles for expenditure of annual grant. (1) Apportionment among provinces.

74. It was strongly urged by the representatives of local Governments and others that it was imperative that the apportionment of any grant among the provinces should be determined in advance according to a fixed formula, and should not be subject to annual discussion and dispute. To this we agree, and we have spent much time in endeavouring to arrive at a formula which would satisfy conflicting claims. Some of the formulæ that we have considered are detailed in paragraph 5 of the report of the sub-committee in Appendix II. It was natural that each province should support the formula that was most favourable to itself. After careful consideration of all proposals, we are of opinion, firstly, that any formula that is to be generally acceptable must be simple and easily calculated; and secondly, that the weight of evidence supports the proposal that the proceeds of an additional duty on motor spirit should be apportioned among the provinces in the ratio which the consumption of petrol in each province bears to the total consumption in India in each year.

75. We accept this principle of apportionment subject to certain qualifications. In the first place, it is, in our opinion, necessary that a part of the proceeds of the additional duty on motor spirit should be retained by the Government of India as a reserve. Apportionment according to petrol consumption means that the larger share will go to provinces in which there are large towns. But the terms of reference to the Committee require consideration of the road system of India as a whole, and it is desirable, therefore, that there should be a reserve available for special grants where for some reason there is need for special aid. Such cases will include projects which are beyond the resources of the local Government immediately concerned and are of sufficient all-India importance to justify a special grant, or again projects which concern more than one province or State, as, for instance, a bridge over a river on a provincial or State boundary. In addition, there will be certain central expenditure on road development, as, for instance, on intelligence and research. We therefore propose that one-sixth of the total proceeds in each year should be retained by the Government of India as a reserve.

Principles recommended.

Secondly, it seems right that the apportionment should extend not only to minor provinces and administrations under the immediate authority of the Governor General in Council, but also to Indian States. The road system of India cannot be satisfactorily developed without the co-operation of the States, through which many arterial routes necessarily run. The additional duty which we propose for purposes of road development will fall alike on petrol consumed in the States and in British India; and it would be unreasonable to expect their co-operation unless they also receive some financial assistance from the proceeds. The way in which such assistance should be given is a matter for arrangement between the Government of India and the States, and is outside the scope of this Committee. All that we now propose is that an apportionment, calculated on the total petrol consumption in minor provinces and administrations and in Indian States, should be allotted as a lump sum to the Government of India.

To put our proposals in a more concrete form, the apportionment on the basis of the petrol consumption in 1927 would approximately have been :—

	Rs. lakhs.
Reserve with the Government of India	10·00
Madras	7·44
Bombay	9·39
Bengal	8·99
United Provinces	2·86
Punjab	4·20
Burma	6·54
Bihar and Orissa	1·80
Central Provinces	1·63
Assam	1·16
Government of India for minor provinces and administrations and Indian States	5·99
Total	60·00

If any part of the amount apportioned to a province remains unexpended at the end of the financial year, it should be carried over for expenditure in that province in the following year.

(2) Approval of projects.

76. Grants should then be made to each province, up to the amount so apportioned to it in each year, for expenditure on projects approved by the Governor General in Council, with the advice of the Standing Committee of the Indian legislature for Roads. It has been suggested by some local Governments that grants from central revenues should be block grants to be spent on roads according to the discretion of each local Government. It does not, however, appear to us to be proper that the Government of India and the Indian legislature, who will be responsible for imposing this additional duty, should divest themselves of all responsibility for the manner in which the proceeds are spent. We believe that strong objection would be taken by the taxpayers on whom the duty will fall, if they were deprived of their constitutional right to influence the expenditure of the proceeds through their representatives in the Indian legislature. Further, as we have already indicated, the need for grants from central revenues for road development has arisen because roads are becoming more than a local concern ; and it is right, therefore, that such grants should be spent in directions in which they appear to the central authority to be most needed. We do not think that the approval of projects on which grants may be spent, in the manner proposed, could reasonably be regarded as undue interference in the responsibility of a local Government for the roads in its province. Examination of the United States Federal Highway Act, which is reproduced in Appendix V, will show that the sovereign States concede to the Federal Government far more control over the expenditure of federal-aid than we are now proposing. In point of fact, no representative of a local Government, in evidence before us, has seriously contested the view that grants from central revenues should only be spent on projects approved by the Governor General in Council.

Principles recommended.

77. The class of projects that might properly be approved, would naturally be a matter for subsequent consideration by the Standing Committee for Roads and by the periodical Conference which we are proposing ; and it would in any case be difficult to suggest any general principle until roads in India have been classified according to some uniform system. Strictly speaking, it might perhaps be correct to confine expenditure from central revenues to projects which may fairly be regarded as benefiting India as a whole, or as aiding the proper administration of a central subject. And ultimately it may be found desirable to restrict grants to roads classed as arterial or to roads, for instance, which are definitely feeders to railways. But until the road system of India takes firmer shape, considerable latitude will probably be found necessary ; and any project in a provincial programme might be approved which is part of a consistent plan of road development. At this stage also, when the financial future of road development is still obscure, it would be unwise to stimulate construction in advance of the capacity to maintain ; and for this reason, we think that grants might be approved for maintenance as well as for construction. Nor does it seem desirable to limit grants to any fixed percentage of the total cost of a project.

Burma.

78. It has been represented by the Government of Burma that the province of Burma is separated from the rest of India by a wide stretch of hill and forest which is entirely roadless, and that its road system is not likely to be connected with the Indian road system within any calculable time. It follows that road development in Burma is a self-contained problem and has no all-India aspects. Recognising the special circumstances, we consider that for the present the amount apportioned to Burma might be spent on any scheme of road development that is approved by the local Government and the local legislature. But if at any future time the question of road connection with India becomes a live issue, the position should be reconsidered.

Standing Committee for Roads.

79. The Standing Committee for Roads, as we have already stated, should be similar in constitution and functions to other departmental Standing Committees. The Chairman would be the Member of the Governor General's Executive Council in charge of the department that deals with roads, and the members would be elected by the two chambers of the Indian legislature. In view of the interdependence of roads and railways, we consider that a representative of the Railway Board, who should also, if possible, be a member of the Indian legislature, should be nominated a member of the Committee. Representatives of other departments of the Government of India which are interested in road development, should attend in an advisory capacity when required. The Secretary to the Committee should be an officer with technical knowledge of road matters, who should be appointed Road Engineer with the Government of India and be attached to the department that deals with roads. The functions of the Committee would be :—

(1) To consider the annual budget and accounts of the separate road development account of the Government of India ;

(2) To consider all road projects submitted by local Governments to the Government of India, for which grants from central revenues are requested ;

(3) To advise the Government of India generally on all questions relating to roads and traffic on roads and, in particular, on—

(*a*) any action to be taken by the Government of India on the proceedings of the periodical Road Conference, which is proposed in paragraph 88 ;

(*b*) central research in all matters connected with roads, road construction and maintenance ;

(*c*) statistics and intelligence, the preparation and publication of maps, and the collection and dissemination of information relating to road development, administration and finance in India and in other countries.

All proposals for expenditure from the annual grant would be submitted for approval to a Finance sub-committee, consisting of the Member in charge as Chairman and all members of the Committee who were members of the Legislative Assembly.

Provincial and local taxation.

80. In paragraph 65 we expressed the opinion that a well-balanced system of additional taxation on motor transport for purposes of road development should include a duty on motor spirit, vehicle taxation and possibly also licence fees for vehicles plying for hire. We have now considered in detail the imposition of an additional duty on motor spirit, and the manner in which the proceeds of the duty should be spent. As a Committee of the Indian legislature, we are primarily concerned with questions of central taxation and the expenditure of central revenues; and under the Scheduled Taxes Rules, vehicle taxes and licence fees for vehicles plying for hire are taxes which the Legislative Council of a province may impose, or authorise any local body to impose, without the previous sanction of the Governor General. It is therefore entirely for local Governments, local legislatures and local bodies to decide what additional taxation of this kind could be borne by motor transport for purposes of road development. We have no desire to trench on matters which are of purely provincial and local concern. Nevertheless it may be useful to summarise the more important points that emerged from the evidence that was pressed upon us.

Vehicle taxation.

81. Vehicle taxation is a common method of taxing motor transport in other countries, and in Great Britain a vehicle tax calculated on horse power is the main source from which the revenue of the Road Fund is derived. It has been seen that the Punjab is the only province in which there is now a provincial vehicle tax; and except in the Madras Presidency and a few large towns this method of taxing motor transport has scarcely been adopted by local bodies. There seems no reason to think that vehicle taxation, where it has been imposed, has in any way retarded the growth of motor transport; and if the proceeds were spent on road development, it might be found to be a positive stimulant. In view of the recent substantial reductions of central taxation on motor transport for general revenues, we think that this source of revenue for road development might with advantage be explored. There appeared, however, from the evidence to be a general desire that vehicle taxation on motors should be provincial rather than local, and should replace local taxes which may be peculiarly harassing to a vehicle with a wide range of movement. It would, of course, be necessary to compensate local bodies by grants from provincial revenues for the loss of income that they might have derived from local imposts. It must also be recognised that the road service provided by different local bodies varies greatly, and could not be equitably financed by uniform provincial taxation. In large cities, for instance, where a costly and efficient road system is maintained, largely for the benefit of motor transport, a local tax in addition to the provincial tax would seem to be justified.

Methods of assessment.

82. We do not propose to discuss the methods of assessing vehicle taxation on motors. The touring sub-committee in paragraph 14 of its report has given some indication of the variety of methods that may be employed. In the United States of America alone there are eleven different methods of taxing private cars and twenty-two methods of taxing motor buses. Detailed examination would have required more time and more knowledge of

technical engineering than the Committee has had at its disposal. It is a question that might well be examined subsequently by the periodical Road Conference which we recommend. We may, however, remark that from many points of view it would be advantageous if provincial vehicle taxation on motors were uniform throughout India, and a system of reciprocal exemptions were arranged so that each vehicle would be taxed only at the place of registration. This would not only be a great convenience and stimulus to the movement of motor traffic. Methods of taxation exercise a direct effect on the type of car used ; and if there is wide diversity, it may tend to discourage the manufacture or assembling of motors in India, which could only be undertaken profitably on a large scale by concentrating on one or two types.

Licence fees for vehicles plying for hire.

83. The scale of licence fees for vehicles plying for hire is a purely local question, depending on local conditions, the roads provided, and the amount of taxation that the traffic is able to bear. There is, however, one aspect that may be mentioned. We refer elsewhere to the evidence we received of the serious damage that is done to roads by many small bus services, and of the need to limit the number that may ply on any particular road. It is understood that in some parts of India licence fees are substantial and not incommensurate with the additional expenditure incurred by the local body that maintains the road on which the service plies. At the same time, the pitch of the licence fees tends automatically to limit the number of vehicles running to the number that the road can economically carry. We have not the material for any definite recommendation. We would only suggest that it might be considered by the authorities concerned whether it would be possible to solve on these lines the problem of correlating public traffic to road capacity, which is daily becoming more difficult in some parts of India.

Loans.

84. It remains to consider how far road development may properly be financed from loans. Different opinions have been expressed in evidence, and the views of local Governments, in particular, somewhat naturally tend to vary according to their present revenue resources. We do not propose to discuss these views in detail. It is a matter that each local Government must consider and decide for itself according to its circumstances. We would, however, deprecate large schemes of road expansion financed by loans, for the service of which provincial revenues might be mortgaged for long periods, while other departments of Government, which may be not less important, are starved. There are also certain principles of general application, which may be briefly stated.

In the first place, only construction or reconstruction should be financed from loans. Loans should be for short periods, and there should be revenue clearly in sight to cover not only the interest and sinking fund charges, but also the cost of maintaining the road when constructed. The history of road bonds in some countries indicates that the future cost of maintenance has sometimes been underestimated, and financial embarrassment has followed.

Secondly, construction from loans should preferably be confined to the more permanent parts of a project, such as a bridge, the life of which can be

estimated with fair accuracy for the calculation of the sinking fund, while the cost of maintenance is small.

Thirdly, provided sufficient data are available to calculate the life of the component parts, it may be found that the reconstruction of a road in more permanent materials from loans may actually effect a saving; that is, the cost of maintaining the reconstructed road plus loan charges may be less than the cost of maintaining the existing road.

Security for loans.

85. It has frequently been suggested in evidence that any additional taxation for the purposes of road development should be utilised as security for a road development loan, and that the proceeds of this taxation should be earmarked for the service of the loan. It should be obvious, however, that the security of a single tax for which no permanency can be guaranteed would be unacceptable for a long term loan, and that any loans for road development should be borrowed in the ordinary way on the security of the revenues of India. Local Governments, however, when preparing their loan programmes, would be justified in taking into consideration the grants from central revenues that they might expect to receive under the scheme of apportionment which we have proposed.

Village roads.

86. We are conscious that we have hitherto confined ourselves to the finance of main road development, and may appear to have neglected to make provision for the subsidiary roads connecting villages with main roads and with one another, which may for convenience be called " village roads ". But as we have already said, a Committee of the Indian legislature should restrict itself as far as possible to questions of central finance, and could not intrude too far into the financial concerns of local Governments and local bodies. Grants from central revenues would naturally be limited to projects which may be regarded as having some all-India significance. In particular, as the additional taxation that we have proposed for purposes of road development will fall entirely on motor transport, the proceeds should be applied to meet its requirements; and we think that strong objection would be taken if they were diverted to any other object. At the same time, the indirect benefit to village roads from our proposals should be substantial. The complaint now is that local Governments and local bodies are incurring increased expenditure on main roads to meet the requirements of motor transport. But if this expenditure can now be met, in part at any rate, from additional taxation on motor transport, the funds so released should be available for expenditure on village roads. In some provinces, contributions are already being made for this purpose, and we hope that one of the results of our proposals will be that these contributions will be substantially increased. We have emphasised the importance of village roads in the general scheme of communications, and we have shown that their condition requires special consideration and relief. The precise measures that should be taken are questions of local self-government that are outside the scope of our enquiry. We can only express the hope that local Governments and local bodies will find it possible to devote more attention and more money to the improvement of village roads in future.

CHAPTER VII.

The co-ordination of road development.

Central Road Board.

87. We have referred in paragraph 25 to the road or communications boards that have been constituted in most provinces. These boards appear to serve a useful purpose in advising local Governments on their road programmes, and it has been freely suggested that a Central Road Board should be appointed to co-ordinate road development throughout India. There is frequently, however, no clear idea of the constitution and functions of such a body. In its extreme form, the suggestion appears to be that the Board should be an independent executive body administering as trustees a separate road fund, to which the proceeds of central taxation on motor transport would be credited. This idea seems to be largely based on a misapprehension of the systems of road administration in other countries, which are sometimes believed to be directed by boards of this kind. It has been seen, however, in Chapter V that the administrative authority in other countries is a department of the Government; in Great Britain, the Ministry of Transport; in France, the national Service of Roads and Bridges; in the United States of America, the Federal Department of Agriculture and the State Highway Departments; in Canada, the Canadian Highways Commission and the provincial Highway Departments; and in New Zealand, the Ministry of Public Works. We have already stated our view that grants from central revenues for road development can only be made through the constitutional processes prescribed by the Government of India Act, and we have formulated our proposals accordingly. It seems unnecessary to pursue this suggestion further. It should be obvious that a subject so closely associated with other branches of administration and with the life of the country generally, could not be removed from the control of the Government and the legislature.

Road Conference

88. There is, however, general agreement that there should be some co-ordinating body, with advisory functions, which would advise the Government of India and local Governments on matters relating to road development and administration. No case, in our opinion, has been made out for the appointment of a permanent body for this purpose. We are strongly opposed to the creation of an elaborate Road Department in the Government of India, which would not only be a needless expense, but might also lead to undue interference and friction with local Governments. We think that all the co-ordination that is now required could be effected through a periodical Road Conference of representatives of the Government of India and the local Governments, who would meet from time to time to exchange views on matters of common concern. The Chairman of the Conference should be the Member of the Governor General's Executive Council in charge of the department which deals with roads, and the members should include the members of the Standing Committee of the Indian legislature for Roads, representatives of other departments

of the Government of India concerned with roads, such as the Railway, Commerce and Army Departments ; provincial Ministers in charge of roads and their Chief Engineers or other technical advisers ; and, if so desired by them, representatives of Indian States. The Road Engineer with the Government of India should be secretary to the Conference. In view of the interdependence of roads and railways, it might be advantageous if meetings of the Conference were held at the same time and place as the annual Railway Conference, in order that subjects of mutual interest might be jointly discussed.

Procedure of the Conference.

89. The Road Conference would settle its own procedure and agenda, and there would be no limit to the subjects that it might discuss. It might sometimes be found convenient to appoint sub-committees to examine questions, particularly questions of a technical character, and report to the Conference. Subjects for discussion might include :—

(1) The classification of roads, and consideration of the classes on which grants from central revenues might properly be spent ;

(2) The co-ordination of the road programmes of adjoining provinces and States ;

(3) The co-ordination of road development with other systems of transport, especially railways and inland waterways ;

(4) Technical questions relating to the construction and maintenance of roads and bridges, and road research :

(5) The taxation of road transport, methods of motor vehicle taxation, and the possibility of uniform taxation and reciprocal exemptions ;

(6) Motor regulations, registration and licensing ;

(7) Statistics and intelligence, including maps.

The members of the Standing Committee for Roads, who would be members of the Conference, would naturally have regard to its views when considering projects for which grants from central revenues were requested. In this way, we think, the co-ordination of road development throughout India would be effectively influenced.

Department of Communications.

90. As we have said, we consider that the creation of a separate Road Department in the Government of India would be unnecessary and undesirable. We are of opinion that the functions of the Government of India in respect of roads can be efficiently performed by one of the existing departments, with the assistance of the Road Engineer with the Government of India whose appointment we recommend. It has, however, been urged by many witnesses that all methods of communication should be dealt with by one department. We have repeatedly emphasised the interdependence of roads and railways ; and other Committees appointed by the Government of India in recent years have made similar recommendations. The Government of India Secretariat Procedure Committee of 1919, in paragraph 19 of its report, recommended :—

> " In the second place it appears to us that following the principles of allocation which we have laid down, there would be great advantage in combining the various duties of Departments

relating to Internal Transport and Communications in a single Department of Ways and Communications, which would embrace Railways, Tramways, Internal Navigation, Ports and Docks, Posts and Telegraphs, Aviation and Road Traffic including Motor legislation."

Again, the Indian Railway Committee of 1920-21 said in paragraph 98 of its report :—

"The advantages of a close relationship between railways, ports, water transport and road transport are obvious. They need correlation by a common controlling authority; they are feeders to each other, but at the same time their conflicting interests as carriers necessitate expert supervision and protection: all methods of transport are necessary for the development of India, and all new schemes, whether for transport by rail, road or water, require to be considered by the same authority as a part of a well-ordered general programme. Only Imperial questions connected with road transport would, under our scheme, come under the immediate supervision of the Ministry, local road questions being left, as now, to local authorities."

Finally, the Indian Retrenchment Committee of 1923 recommended that a Communications Department should be constituted. We are of opinion that these recommendations should be reconsidered, and that the Government of India should again examine the possibility of bringing together all matters relating to communications and transport into one department. It is particularly important, from the point of view of this Committee, that the development of roads and railways should be directed by a single policy.

CHAPTER VIII.

Miscellaneous.

Contributions by railways.

91. It was represented to us that a local body in some cases may incur considerable expenditure on a road which is mainly used by traffic to and from a railway station, without much immediate benefit to the local area through which the road passes. In other cases, a local body may be financially unable to provide the feeder roads that the railway administration may require in order to develop its traffic. It was suggested that it would be reasonable and in the interests of the railway administration that it should contribute towards the construction and maintenance of such roads. It appears, however, from the evidence of the representatives of the Railway Board, that it is doubtful whether any contribution is legally possible, as the Indian Railways Act and the Devolution Rules now stand. If there were no legal disability, the railway administration would be prepared to consider each case on its merits as a commercial proposition. We are of opinion, therefore, that it would be desirable to make any amendments of the law or of the Devolution Rules that may be necessary for this purpose.

Contributions from the Army budget.

92. It has been argued that, as the Army is a central subject, the Government of India in the Army Department should contribute towards the repair of damage done to roads by military transport, or even towards the upkeep of roads which are of military value. It was admitted by the representatives of Army Headquarters that damage was done to roads by military transport, and it would seem to be not unfair that the cost of repair, which now falls on provincial revenues or local funds, should be relieved by a contribution from the Army budget. We also understand that in the North-West Frontier Province, when a road or bridge is required for military reasons to be of a higher class than is necessary for civil purposes, part of the cost is charged to the Army budget. We think that this principle should be extended to other provinces. For instance, we were told of one case where a local Government had proposed to build a causeway across a river at a cost of Rs. 4 lakhs, but at the request of the military authorities is now building a high level bridge at a cost of about Rs. 15 lakhs. This would appear to be a case where part of the cost should be borne from the Army budget.

Monopolies of public motor services.

93. It was suggested by several local bodies and by individual witnesses that the development of motor transport and of the road system generally would be furthered by the grant of monopolies of the public motor services on certain roads. It was argued, firstly, that public motor services are now frequently run by persons without capital, in acute competition with one another with the result that the services are irregular, the

vehicles employed are often unsafe and badly driven, and the travelling public is inconvenienced and sometimes endangered; while a monopoly service would be operated with adequate finance and under proper supervision, so as to provide regular and efficient services at reasonable rates. Secondly, it was argued that this multiplicity of small services is seriously damaging the roads without making any direct contribution to the cost of repairs; while monopolies might be sold for substantial amounts which might be an important addition to the funds available for expenditure on roads. We were informed that some local bodies had even received offers from private companies to construct and maintain a length of road in return for a monopoly of the public motor services on it for a term of years. On the other hand, it was urged that competition was in the public interest, that it kept fares at the lowest possible rate and forced bus owners to oblige the public and meet its requirements, and that the failure of a few individuals and occasional accidents were not enough to outweigh the accepted objections to monopolies. In our opinion, monopoly services are undesirable, because they restrict competition and may lead to many obvious abuses. It is clear, however, from the evidence that some limitation of the public motor services on certain roads may be required. We have already suggested in paragraph 83 that this limitation might be effected by an adjustment of the licence fees for vehicles plying for hire.

Tolls.

94. We have referred in paragraph 63 to road tolls as a method of taxing motor transport, and it has been seen that in the Madras Presidency a substantial revenue is raised by local bodies from this source. Toll bars, which are usually about ten miles apart, are particularly obstructive to a rapid form of road transport, and it has frequently been urged that direct provincial taxation should be substituted for tolls on motor vehicles. In our opinion, however, the objection to tolls goes far beyond the obstruction to motor transport. We have received ample evidence of the harassment to traffic of all kinds, and there is a strong demand that tolls should be altogether abolished. It may be argued, indeed, that tolls are paid in direct proportion to the use made of the road, that they are paid in small sums which the road user can afford, and that they are traditional to the country and cannot readily be replaced by any other form of taxation. But it is not disputed that delay to traffic and annoyance to the public are inevitable incidents of the system. An additional objection is the practice of farming tolls, which diverts a considerable part of the receipts to the farmer. Tolls are a source of local taxation with which, as we have said, we are not directly concerned. We may, however, express a hope that tolls on all traffic will be abolished as soon as possible and be replaced where necessary by some form of taxation that is less vexatious to road transport.

Tolls on bridges.

95. We would, however, except tolls on bridges, where a definite service is provided to replace a ferry or a bad river crossing. Tolls in such cases may make a substantial contribution towards the cost of the work, without which perhaps it could not be undertaken. For instance, the tolls on the Nerbudda bridge on the Bombay-Agra road, which was built at a cost of Rs. 4½ lakhs, produce an average annual income of Rs. 25,000. It appeared from the evidence that the public was not averse in such cases to paying tolls for special facilities.

CHAPTER IX.

Summary of recommendations.

96. Our conclusions and recommendations may be summarised as follows :— Summary of recommendations.

A.—The desirability of developing the road system of India.

The development of the road system of India is desirable for the general welfare of the country as a whole, and in particular —

(*a*) for the better marketing of agricultural produce ;

(*b*) for the social and political progress of the rural population, which will be advanced by the increased use of motor transport ;

(*c*) as a complement to railway development.

B.—The means by which road development in India could most suitably be financed.

(1) Road development in India is passing beyond the financial capacity of local Governments and local bodies, and is becoming a national interest which may, to some extent, be a proper charge on central revenues.

(2) Road development, in so far as it contributes to the general welfare of the country as a whole, is a proper charge on general revenues but no increase in the expenditure on roads from existing revenues is recommended.

(3) To meet the additional demands and requirements created by the growth of motor transport, some additional taxation might be imposed on motor transport for purposes of road development over and above the existing taxation for general revenues.

(4) A well-balanced scheme of additional taxation on motor transport for purposes of road development, should include—

(*a*) a duty on motor spirit ;

(*b*) vehicle taxation ;

(*c*) licence fees for vehicles plying for hire.

(5) The duty on motor spirit might be raised again to 6 annas per gallon without affecting consumption, provided that the additional 2 annas now imposed is spent on road development.

(6) The amount so realised would be Rs. 62 lakhs on the figures of 1927-28, but the consumption of petrol has been increasing annually

at the rate of 30 per cent compound interest. Further, if the time arrives when it is possible to abolish or reduce taxation on motor spirit for general revenues, the Government of India might consider the desirability of retaining the tax for purposes of road development.

(7) An effort should be made to induce the oil companies to co-operate with the railway administration in reducing the price of petrol in inland towns.

(8) The duty on motor spirit is a source of central revenue, and grant from central revenues for road development can only be made through the constitutional processes prescribed by the Government of India Act.

(9) As grants for road development cannot be used effectively unless some continuity is assured, a convention should be established for five years, whereby the Legislative Assembly would annually vote the proceeds of the additional duty on motor spirit as a block grant for expenditure on road development. This annual grant should be credited to a separate road development account, and unexpended balances should not lapse at the end of the financial year.

(10) The Legislative Assembly should continue to exercise control over the expenditure of the annual grant in two ways—

(*a*) The general principles in accordance with which the grant should be spent should be approved by the Assembly;

(*b*) A Standing Committee of the Indian legislature for Roads should be appointed, similar in constitution and functions to other departmental Standing Committees, which would advise the Governor General in Council on all matters relating to roads; and all proposals for expenditure from the annual grant should be submitted for approval to a Finance sub-committee, consisting of the Member of the Governor General's Executive Council in charge as Chairman and all members of the Standing Committee who are members of the Legislative Assembly.

(11) The annual grant should be divided as follows—

(*a*) One-sixth should be retained by the Government of India as a reserve;

(*b*) Out of the remaining five-sixths—

(*i*) An apportionment should be made among the provinces in the ratio which the consumption of petrol in each province bears to the total consumption in India in each year;

(*ii*) The balance, representing the consumption of petrol in minor provinces and administrations and Indian States, should be allotted as a lump sum to the Government of India.

If any part of the amount apportioned to a province remains unexpended at the end of the financial year, it should be carried over for expenditure in that province in the following year.

(12) Grants should be made to each province, up to the amount so apportioned to it in each year, for expenditure on projects approved by the Governor General in Council with the advice of the Standing Committee of the Indian legislature for Roads.

(13) The amount apportioned to Burma may for the present be spent on any scheme of road development that is approved by the local Government and the local legislature. But if at any future time the question of road connection with India becomes a live issue, the position should be reconsidered.

(14) Vehicle taxes and licence fees for vehicles plying for hire are sources of provincial or local revenue, and it is entirely for local Governments, local legislatures and local bodies to decide what additional taxation of this kind could be borne by motor transport for purposes of road development.

(15) Except in certain areas vehicle taxation has scarcely been adopted as a method of taxing motor transport ; and in view of the recent substantial reduction of central taxation for general revenues, this source of revenue for road development might with advantage be explored.

(16) There is a general desire that vehicle taxation should be provincial rather than local, and that a system of reciprocal exemptions should be arranged so that each vehicle would be taxed only at the place of registration.

(17) The scale of licence fees for vehicles plying for hire depends on local conditions, but it might be considered by the authorities concerned whether licence fees might not be pitched so as to limit the number of vehicles plying on any road to the number that the road can economically carry.

(18) The propriety of financing road development from loans must be decided by each local Government for itself according to its circumstances, but certain principles of general application are suggested.

(19) Loans should be borrowed in the ordinary way on the security of the revenues of India, and not on the security of a special road development tax.

(20) Village roads should benefit indirectly by the release of provincial revenues and local funds which are now being spent on main roads to meet the requirements of motor transport. In view of

the importance of village roads in the general scheme of communications, it is hoped that they will receive more attention and larger grants from local Governments and local bodies in future.

C.—The co-ordination of road development.

(1) The appointment of a Central Road Board with executive powers, administering a separate road fund, is not recommended.

(2) A periodical Road Conference, consisting of the Member of the Governor General's Executive Council in charge as Chairman, the members of the Standing Committee of the Indian legislature for Roads, representatives of the departments of the Government of India concerned with roads, representatives of the local Governments and, if so desired by them, of Indian States, should meet from time to time to discuss subjects of common interest, and might appoint sub-committees to examine questions of a technical character and report to the Conference.

(3) A separate Road Department in the Government of India would be unnecessary and undesirable; but a Road Engineer with the Government of India should be attached to the department that deals with roads.

(4) The Government of India should reconsider the recommendations of previous Committees that all matters relating to communications and transport should be dealt with by one department.

D.—Miscellaneous.

(1) The Indian Railways Act and the Devolution Rules should be amended so as to enable the railway administration to contribute towards the construction and maintenance of feeder roads.

(2) A contribution should be made from the Army budget towards the cost of repairing damage done to roads by military transport; and when a road or bridge is required for military reasons to be of higher class than is necessary for civil purposes, part of the cost should be borne from the Army budget.

(3) Monopolies of public motor services on roads are undesirable.

(4) Road tolls on all traffic should be abolished as soon as possible, except tolls on bridges where a definite service is provided to replace a ferry or a bad river crossing.

Acknowledgments.

97. In conclusion we wish to thank local Governments and local bodies for the assistance they have given us in our enquiry, and also individual witnesses who frequently came from long distances to give evidence before us.

Our grateful acknowledgments are due to our Secretary, Mr. H. F. Knight, and our Technical Adviser, Mr. K. G. Mitchell, to Mr. H. N. Khanna, Superintendent, and the subordinate staff for their valuable assistance.

M. R. JAYAKAR, *Chairman.*

G. L. CORBETT.

A. H. FROOM.

GANGANAND SINHA.

GHAZANFAR ALI.

LAJPAT RAI.

M. SUHRAWARDY.

MD. ANWARUL AZIM.

MD. ISMAIL KHAN.

U. RAMA RAU.

K. V. RANGASWAMY AYYANGAR.

SHIVDEV SINGH UBEROI.

E. F. SYKES.

NOTE.—Diwan Chaman Lal agreed to the conclusions reached by the Committee at its meetings at Bombay in April, but owing to his absence from India he was unable to be present at Poona in July when the report was considered.

APPENDICES.

CONTENTS.

APPENDIX I.

Resolution of the Government of India appointing the Committee.

Department of Commerce Resolution No. 489-T. (1), dated New Delhi, the 3rd November 1927.

The following Resolution on the subject of road development was unanimously adopted by the Council of State on the 9th February 1927 :—

> " That this Council recommends to the Governor General in Council, to appoint a Committee, including members of both Houses of the Central Legislature to examine the desirability of developing the road system of India, the means by which such development could be most suitably financed, and to consider the formation of a Central Road Board for the purpose of advising in regard to, and co-ordinating the policy in respect of, road development in India."

2. In accordance with this Resolution the Governor General in Council after consultation with the local Governments, has decided to appoint a Committee, consisting of members of the two Chambers of the Indian Legislature, with the following terms of reference :—

(1) To examine the desirability of developing the road system of India and, in particular, the means by which such development could most suitably be financed ; and

(2) To consider, with due regard to the distribution of central and provincial functions, whether it is desirable that steps should be taken for the co-ordination of road development and research in road construction, by the formation of a Central Road Board or otherwise.

3. The following gentlemen have agreed to serve on the Committee :—

Chairman :

Mr. M. R. JAYAKAR, Bar-at-Law, M.L.A.

Members :

1. DIWAN CHAMAN LAL, M.L.A.
2. The Hon'ble Sir GEOFFREY CORBETT, K.B.E., C.I.E., I.C.S.
3. The Hon'ble Sir ARTHUR FROOM, Kt.
4. KUMAR GANGANAND SINHA, M.L.A.
5. RAJA GHAZANFAR ALI KHAN, M.L.A.
6. Lala LAJPAT RAI, M.L.A.
7. The Hon'ble Mr. MAHMOOD SUHRAWARDY.
8. Mr. MD. ANWARUL AZIM, M.L.A.
9. Mr. MUHAMMAD ISMAIL KHAN, M.L.A.
10. The Hon'ble Dr. U. RAMA RAU.
11. Mr. K. V. RANGASWAMY AYYANGAR, M.L.A.
12. The Hon'ble SARDAR SHIVDEV SINGH UBEROI.
13. MR. E. F. SYKES, M.L.A.

Mr. H. F. Knight, I.C.S., will act as Secretary and Mr. K. G. Mitchell, A.C.G.I., A.M.I.C.E., A.M.Inst.T., as Technical Adviser to the Committee.

4. The Committee will assemble immediately at New Delhi to decide its procedure. It is desired that the Committee should obtain and consider the views of all local Governments, and should also examine such persons, associations and other bodies as it thinks necessary. Persons who desire to be called as witnesses should apply in writing to the Secretary, care of Department of Commerce, Government of India, New Delhi, giving their full names and addresses, together with a brief memorandum of the points on which they desire to give evidence.

5. The Government of India hope that local Governments and Administrations will afford the Committee all the assistance which it may require and will comply with any request for information which may be addressed to them by it.

APPENDIX II.

Report of the touring sub-committee.

At a meeting of the Road Development Committee held on the 6th November 1927 at New Delhi, the following Sub-Committee to tour the provinces in order to collect information was appointed:

Chairman :

The Hon'ble Sir ARTHUR FROOM, KT.

Members :

The Hon'ble Mr. MAHMOOD SUHRAWARDY and

KUMAR GANGANAND SINHA, M.L.A.

with Mr. K. G. MITCHELL, *Technical Adviser* and Mr. H. F. KNIGHT, I.C.S., *Secretary*.

It was also decided that other members of the Committee should join the Sub-Committee in their respective provinces when it goes to the headquarters of the local Governments of those provinces. The Sub-Committee was accordingly assisted in their inquiries by Mr. Md. Anwarul Azim, M.L.A., in Calcutta, the Hon'ble Dr. U. Rama Rau and Mr. K. V. Rangaswamy Ayyangar, M.L.A., in Madras, and by Mr. E. F. Sykes, M.L.A., in Bombay.

PART I.

The Sub-Committee's instructions were :—

" (*a*) The Sub-Committee should obtain information from local Governments, local bodies and associations interested in road development on the points included in the questionnaire, and secure that the information supplied from each province is as uniform and complete as possible.

(*b*) The Sub-Committee, before proceeding on tour, should request local Governments to supply their own officials and local bodies and associations with copies of the questionnaire, and ask them to be prepared to meet the Sub-Committee and furnish the information required.

(*c*) The answers to the questionnaire are to be compiled province by province and to be printed and circulated to members of the full Committee as completed.

(*d*) The Sub-Committee should not examine representatives of the Railway Department or of Army Headquarters who will be invited to give evidence before the full Committee."

Our programme was sent to Members of the Committee on the 15th November 1927. We found it impossible in the time available to visit Burma or Karachi, and have had to leave until after Christmas the visit to Lahore concerning which we will submit a separate report.

We visited Allahabad, Shillong, Calcutta, Patna, Nagpur, Madras and Bombay and held informal discussions on road development with

14 Honourable Members and Honourable Ministers of local Governments.

37 Secretaries, Chief Engineers and other representatives of local Governments.

54 representatives of District Boards.

51 representatives of Commercial and other Associations.

14 private individuals.

Memoranda of all these discussions are being sent to Members. We also inspected improved methods of road construction in Calcutta, Patna and Bombay, and visited the Government Test House, Alipore.

2. We take it that the Road Development Committee do not desire the Sub-Committee to discuss in detail the answers received to the questionnaire as these are all being printed and despatched to Members of the Committee who will wish to form their own opinions thereon. This Report therefore is confined mainly to the information obtained by us as the result of discussions during our tour. There is no need to give the history of roads in India with which the Members are sufficiently acquainted,

but it must be admitted that, compared with many other countries, the Indian road system is undeveloped:

	Nine Major Provinces of India.		United States of America.	
Density of Population	240		31·5	
	Per 100 sq. miles of area.	Per 100,000 of population.	Per 100 sq. miles of area.	Per 100,000 of population.
Mileage of all roads ..	20·18	83·90	80	2,550
Surfaced roads ..	5·38	22·30	12·05	383
Percentage of roads surfaced.	26·5		15·0	

On our tour we found that the backwardness of the Indian road system was universally recognised, and considerable enthusiasm was shown for road development. The recent development of motor passenger transport is appreciated as bringing the facility of rapid travel within reach of millions of the population down to the poorest; while the value of good roads to the cultivator bringing his produce to market is shown by the insistent demand for improved roads and new roads in every province. But, at the same time, the increase of traffic of recent years has led to anxiety as to how roads can be kept up under modern conditions with the money and material available.

PART II.

3. The experience of our tour shows that an improvement in the present unsatisfactory condition of roads in India is eagerly looked for, and we found an almost universal agreement that it is desirable to constitute a Central Road Board with advisory functions to co-ordinate road development, especially on all-India and inter-Provincial roads, to co-ordinate the development of Roads and Railways and to stimulate and co-ordinate research into road-making. It was equally recognised that a corollary to such a Central Board must be Provincial Road Boards or Provincial Communications Boards. Such already exist in the Punjab, the United Provinces, the Central Provinces, Assam, Madras and Bombay. In some quarters the view was expressed that in order to give productive effect to the generally expressed wish for road development in India a Central Board of Communications or a Ministry of Transport should be constituted with executive powers.

We received complaint that when consideration is taken of the import duties on motor cars, on tyres, and spare parts, and of the present petrol excise, motor vehicles are already heavily taxed indirectly and there is a general demand for a reduction in the present import duties or for an equivalent assignment from Central Revenues to road development.

4. It was equally recognised that an immediate improvement of roads is impossible without additional funds and we found very general agreement that the best method of obtaining this would be by means of an increase in the excise and customs duty on petrol, the amount produced by this increase being exclusively devoted to road development. The increase most generally suggested was 2 annas per gallon but there was a certain body of opinion that favoured a 4 annas increase.

The advantages of such a tax appear to be :—

(*i*) ease and cheapness of collection;

(*ii*) impossibility of evasion; and

(*iii*) fairness as proportioning the tax to road use.

It was, however, strongly emphasized before us by almost all

(*i*) that the proceeds of such increase in the excise would have to be definitely earmarked for roads, if such a tax is to meet with public approval ; and

(*ii*) that under modern conditions, the present excise of 4 annas on petrol conflicts with the principle that transport should not be taxed except for the benefit of transport, and that, as soon as finances permit, the present excise should be diverted to road development.

5. As to how funds raised by the Central Government for road development should be spent, or should be allotted among the provinces, we found less agreement. The simplest method of division—*i.e.*, that each province should receive its share of the extra 2 annas excise on petrol according to the amount of petrol consumed in that province—was in favour in Bengal and Bombay. But this was objected to in some other provinces on the following grounds :—

(*i*) The heavy consumption of petrol in the cities of Calcutta and Bombay would result in Bengal and Bombay provincial revenues obtaining an excessive share.

(*ii*) The object of the Central Road Board would be the development of the roads of India as a whole and assistance to provinces based on the fortuitous position of large cities would be unfair.

It appeared to us that there is force in these objections and we have therefore sought for other methods of distribution, and discussed them with local Governments and others. It was not to be expected that a single formula would satisfy the representatives of every province who naturally wish to do their best for the finances of their province, and therefore favour such distribution as will give it the largest share. But we found universal agreement that a definite formula for fixing the share which any province might get from any Central Road Development Funds is necessary, in order to enable provinces to map out programmes of road development ahead.

We think that division on something on the lines adopted in the United States of America would meet with acceptance. For example, any funds made available from Central taxation might be divided among the provinces as follows:—

(1) one-fourth of the total should be divided among provinces according to their proportionate area to their total area ;

(2) one-fourth of the total should be divided among provinces according to their proportionate population to their total population;

(3) one-fourth of the total should be divided among the provinces according to the proportion of their total annual expenditure on road maintenance in all the provinces :

(4) one-fourth of the total should be divided among the provinces according to their proportionate petrol consumption to the total petrol consumption.

The addition of the shares under each of these factors would give each province's total grant* We realise, and those whom we met also realised, that there are criticisms applicable to each factor, *e.g.*,

(1) Total area would benefit a province with a large desert or forest area where roads may not be needed ;

(2) Population would be to the disadvantage of a sparsely populated province where roads must needs be long ;

(3) Expenditure on roads takes no account whether the money is well spent or wasted, and it favours a rich province at the expense of a poor one ;

(4) Petrol consumption is open to the objection that it unduly favours provinces with large cities.

But, in view of our informal discussions with many persons during our tour, we have formed the opinion that the Committee may find it possible to reach an agreed basis for division accepted by the provinces in this or some similar formula.

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*We have not considered the position of the territories directly under the Government of India or of the Indian States in any such petrol excise revenue. We presume that they will receive a share, whether directly or indirectly, from the Government of India, provided they participate in a unified road development policy.

As a basis for discussion we have tentatively worked out the effect of some various formulæ suggested. A 2 annas petrol excise is likely to yield Rs. 60 lakhs, or possibly more in 1927-28, and, as part of this would go to the share of the administered territories and Indian States, we have assumed that Rs. 50 lakhs would be available for distribution among the major provinces. (On 7 months' figures for 1927, Rs. 46½ lakhs would be the share of the provinces, but the latter part of the year is likely to raise this figure—we have therefore assumed Rs. 50 lakhs as available). The figures we give below are merely approximate and may be liable to modification when more accurate information as to provincial expenditure on roads and provincial petrol consumption becomes available.

The figures give the share in lakhs of the provinces from a Central Fund of Rs. 50 lakhs:—

Province.	I.	II.	III.	IV.	V.
Madras	7·5	8·5	8·05	8·12	7·9
Bombay	12·0	9·25	7·12	7·37	8·2
Bengal	10·5	7·5	7·25	7·37	8·2
United Provinces	3·5	4·25	5·75	6·0	5·8
Punjab	3·5	4·75	4·5	4·62	4·5
Burma	7·0	7·25	7·25	6·0	5·7
Bihar & Orissa	2·5	3·25	4·37	4·62	4·2
Central Provinces	2·0	3·25	3·72	3·62	3·2
Assam	1·5	2·0	2·0	2·25	2·3
Total ..	50·0	50·0	50·01	49·97	50·0

I. This is the share due to each province on a basis of proportionate petrol consumption alone.

II. This combines the two factors of :

(*i*) provincial expenditure on road and

(*ii*) petrol consumption.

III. This combines the four factors of :

(*i*) gross area,

(*ii*) population,

(*iii*) road expenditure from revenue and

(*iv*) petrol consumption.

IV. This combines the four factors of :

(*i*) area, taken as whole cultivated area of the province *plus* ¼ the uncultivated area, to obviate the effect of areas which require no roads.

(*ii*) population,

(*iii*) road expenditure and

(*iv*) petrol consumption.

V. This combines the same four factors as IV, but to meet the objection that provinces which provide the most petrol revenue should receive consideration for this, the petrol consumption factor is given value double that of each of the other factors.

6. As regards the objects on which such a Central Road Development Fund might be spent, we found an impression in some places that, in the imposition of a central petrol tax, the Central Government would be merely acting as agent for the provinces in collecting a petrol excise to take the place of a provincial motor vehicle tax, and that the proceeds should be handed over to local Governments to spend as they wished.

It appeared to us, however, that this was not contemplated by the terms of reference to the Committee which seems to postulate in the first place a comprehensive development of the roads of India as a whole rather than the immediate augmentation of provincial funds for roads in general, and we think we have indicated this sufficiently to those whom we met and general agreement was reached that the primary objects of expenditure should be the development of roads of all-India or inter-Provincial importance. We recognise however that in framing any classification of roads as of all-India or inter-Provincial importance, special consideration will be necessary in the case of certain provinces where through routes are few or impossible It should be possible however for the Central Road Board, if and when constituted, to settle this problem of classification. It was impressed upon us however that under no consideration should any part of the share in the Central Fund falling to one province be diverted to any other province.

7. It is clear that the proceeds of the additional proposed 2 annas increase in the petrol excise, which is estimated to produce about Rs. 60 lakhs in 1927-28, will not, when divided among the provinces, allow of large schemes of road development from revenue, and we found an almost universal demand that the proceeds of such an additional 2 annas petrol excise should be made available to provide for interest and sinking fund charges on capital road expenditure incurred out of loan funds by provincial Governments. We see no objection to this ; it is universally recognised that expenditure on construction and reconstruction of bridges and culverts and on some of the more permanent items of road-making, such as embankments, can be rightly incurred out of capital, and provided care is taken not to finance short-lived work, such as surfacing, out of loan, the policy is sound. An annual revenue of Rs. 60 lakhs from petrol excise would allow an immediate capital expenditure of about Rs. 9 crores on a 30 year basis borrowing at 5¼ per cent But the objection has been put to us that provincial Governments will hesitate to undertake such fresh capital expenditure unless they can be assured of the recurring income from the petrol excise needed to provide the interest and sinking fund charges on their loans, and it was suggested to us that it would be advisable to earmark this petrol excise by the constitution of a statutory Road Fund, to which it should be annually paid, in order to ensure that funds might be continuously available in the future to assist local Governments.

We suggest that the Committee might consider whether the Legislature would be likely to agree to such a proposal, which not only appears in consonance with road development in other countries but has received the support of every person, official and non-official, who has discussed the matter with us.

If a statutory Road Fund be established, with an agreed formula for division among the provinces, then local Governments could embark on loans for road development with the guarantee of certain annual sums available for interest and sinking fund. Such guaranteed income seems imperative if any substantial progress in road development is to be made in the near future.

8. We report to the Committee that public opinion generally is in favour of the following proposals:—

(*i*) The desirability of an Advisory Central Road Board ;

(*ii*) The imposition of an extra 2 annas excise on petrol to form a Central Fund, the proceeds to be earmarked for road development ;

(*iii*) The division of the proceeds among the provinces on an accepted formula ;

(*iv*) The proceeds to be spent primarily on roads of all-India or inter-Provincial importance;

(*v*) Such expenditure to be additional to, and not in place of, any normal provincial expenditure on roads ;

(*vi*) The Central Fund should be available to finance interest and sinking fund charges on capital road works constructed out of loan by provincial Governments;

(*vii*) For this purpose the provinces should be assured annual receipt of their shares by the constitution of a permanent Road Fund.

PART III.

9. The terms of reference to the Committee are :—

(1) To examine the desirability of developing the road system of India and, in particular, the means by which such development could most suitably be financed; and

(2) To consider, with due regard to the distribution of central and provincial functions, whether it is desirable that steps should be taken for the co-ordination of road development and research in road construction, by the formation of a Central Road Board or otherwise;

and it was clear from these terms of reference that it was impossible to avoid consideration of provincial road problems, nor did those whom we met desire us to do so, and, at the same time, it is equally clear that the provision of roads to reach the mass of the population must be the concern of the provincial Governments and the various local authorities.

We were informed in several provinces that roads in general are deteriorating, and that modern traffic is demanding more expensive forms of road construction, while provincial and local authorities' revenues are not expanding to meet these needs. It was clear that there is general recognition of the need for more and better roads, but that the financial difficulty is in the way.

No panacea to remedy this was suggested to us, but from our discussions we conclude that public opinion is in favour of certain changes in road management. In several provinces there are in existence Road Boards or Communications Boards of an advisory character, and with the assistance of such bodies, it should not be difficult to draw up a classification of roads in each province into, *e.g.*,

(*i*) all-India arterial roads,

(*ii*) provincial roads, *i.e.*, main roads necessary for internal communication between divisions or districts,

(*iii*) district roads, which would primarily serve the needs of a single district, and

(*iv*) village roads

It was put to us that the all-India roads should be maintained by provincial funds with aid from the Central Fund, that provincial roads should be maintained by provincial funds without cost to local authorities, that district roads should be maintained by local authorities with or without aid from provincial funds, and that village roads should be maintained by local authorities only.

10. The reasons given for relieving local authorities from the upkeep of provincial main roads in those cases where such are not maintained by the local Government, were

(*i*) that District Boards, with their inelastic revenues and the pressing demands of education and sanitation, cannot afford to keep up their roads to modern standards;

(*ii*) that in many cases the District Boards are able only to take account of the needs of their own district, and, where an important provincial main road runs through a district, the District Board tends to maintain only such portion as is of local importance;

(*iii*) owing to the varying efficiency and varying finances of various District Boards, the upkeep of through roads varies undesirably from district to district.

This proposal was generally favoured, and the system suggested appears necessary for any comprehensive road development. Some such classification of roads has been found necessary in almost every country.

11. The exact method of ' Provincialisation ' of main provincial roads, where such are not already in charge of the Public Works Department, would have to depend on local conditions. Some Presidents of District Boards desired that the local Government should assume entire charge of such roads through the Public Works Department. Others preferred that the local Governments should pay the local bodies the cost of maintenance and leave the work to be done by the District Board staff, with inspection by the Public Works Department officers. We were informed that the latter system was found satisfactory in Berar, and to some extent in Madras, but elsewhere opinion was not so favourable to it. We suggest that maintenance by the Public Works Department or by District Board staff must depend on the individual efficiency of District Boards and that no hard and fast rule is possible, but that the primary object of good roads must be kept in view uninfluenced by other considerations, and that, *prima facie*, divided control is undesirable.

A further proviso which we were asked should be laid down, was that in the event of local authorities being relieved of the cost of ' Provincial ' roads, this should not lead to a diminution of the total amount spent on roads by a local authority. It was pointed out to us that the pressing need of education is apt to absorb the available funds of local authorities, and that if more money be provided by the local Government for roads, such must be in addition to, and not in place of, any money previously spent on roads. This appears to us reasonable, and we suggest the Committee might indicate to local Governments the necessity of control in this direction ; without such proviso, the release of money previously spent by District Boards on ' Provincial ' roads will lead to no improvement in district roads which concern the cultivator most closely. The main object in furthering any road development of India is to ameliorate the economic condition of the agriculturist.

12. The proposal that local Governments should take over the main inter-division and inter-district roads in each province will involve in most cases a further charge on provincial revenues, and we agree that in most provinces revenue is not expanding and that a further increase in general taxation is undesirable.

That roads should be largely supported out of general revenues is an axiom which we do not dispute. The benefits to a country of a system of good roads are almost incalculable : in particular in India with a very large agricultural population, whose livelihood largely depends on their ability to take the produce of their fields to market, good roads are an especial need. This we found recognised everywhere and we wish that funds permitted the provision of a road to every village. We might also draw attention to the Note* on Highway Finance by Mr. J. N. Willys, of which copies have been sent to Members, in which he shows that the good roads in the United States of America are not the result of the country's

*Not printed.

prosperity but the prosperity of the country is largely the result of a forward policy in financing road construction out of general revenues, with the effect that now in America motor vehicle taxation is practically sufficient for the maintenance of roads. We do not, of course, suggest that such a condition of affairs can be attained in India in the near future, but, while holding that much road expenditure should be met from general revenues, we are of opinion that certain classes who particularly benefit from roads—*e.g.*, those who use them whether by bullock cart or motor car or other vehicles—should bear an additional share in road maintenance beyond whatever they may contribute to the upkeep of roads through their payment to general revenues.

13. To deal first with Motor Vehicles. We find there is little uniformity in their taxation, apart from the indirect taxation effected by the import duties on cars, accessories, tyres, and by the petrol excise. The forms of taxation now in force are :—

(*i*) *Vehicle registration fee on purchase.*—Rs. 16 to 20, usually not a recurring charge, though in some provinces an annual renewal fee of Rs. 2 or so is in force. This " taxation " is primarily imposed for Police control on motor vehicles, and it has been recognised (see the Taxation Enquiry Committee's report, para. 319) that the charges should be calculated only to cover the cost of administration concerned.

(*ii*) *Direct provincial taxation.*—This only exists in the Punjab, where it is calculated on seating capacity. (See Punjab Act IV of 1924.) The U. P. provincial taxation was repealed. Bombay and Bengal had proposed provincial petrol taxation before the Committee was started.

(*iii*) *Direct local taxation.*—This, with the exception of one or two Local Boards in the Central Provinces, is only levied by municipalities ; and Local Boards, whose roads are largely used by motor vehicles, receive nothing. The rates vary from the high scale of Bombay—Rs. 80 per annum and upwards —to a few rupees a year in smaller municipalities.

(*iv*) *Indirect municipal taxation by octroi or terminal tax on petrol, tyres, etc.*—This is probably not a serious item as no complaints were received.

(*v*) *Tolls.*—These vary in the provinces; in Madras it was stated to us that the total revenue raised from motor vehicles in the form of road toll was about Rs. 9 lakhs. (We were informed that in Madras the direct local taxation of motor vehicles and the tolls levied on motor vehicles were together equivalent to a tax of Rs. 100 per annum per car.)

With the exception of Madras and Bombay City, it was generally felt that there is room for further taxation of motor vehicles for provincial revenues without hampering the development of transport, and we suggest to the Committee that local Governments be advised to raise some of the money required for roads by means of provincial motor vehicle taxation.

14. We have not thought it within our province to examine closely the varied possible methods of taxation of motor vehicles. The Departmental

Committee on the Taxation and Regulation of Road Vehicles in Great Britain considered the following methods :—

" (A) The present system (*i.e.*, taxation by horse-power) to be abolished entirely, and a motor spirit duty substituted.

(*B*) Taxation to be based on unladen weight, with or without an additional percentage for load, and with a rebate on vehicles fitted with pneumatic tyres.

(*C*) Combinations of A and B, or of A and the present system.

(*D*) Tax to be based on a combination of horse-power and weight, or upon a combination of horse-power, weight, and nature of tyres.

(*E*) A wheel tax varying according to the type of vehicle, combined with a motor spirit duty of 1*d.* per gallon.

(*F*) Taxation on an *ad valorem* basis for all vehicles, with a sliding scale according to the age of the vehicle, and a duty of 2*d.* per gallon on imported motor spirit.

(*G*) Taxation to be based upon a combination of horse-power tax and a petrol duty, with a reduction in favour of pneumatic tyres. Also an increased tax for trailers.

(*H*) Taxation to be based upon a combination of weight and mileage, or a combination of weight, mileage and nature of tyres.

(*I*) Vehicles with internal combustion engines to be taxed on the cubic capacity of the engine cylinders, regardless of the purpose to which the vehicle is put; other mechanically-propelled vehicles to be taxed on unladen weight.

(*J*) The remaining suggestions were merely for the partial amendment of the present scheme, *e.g.*, heavier taxation of traction engines in view of their noise and the wear and tear caused by them to the roads, etc."

Provinces may have individual preferences for certain forms of taxation and we have not yet had the opportunity of discussion in the Punjab, which is the only province with a provincial motor vehicle tax in operation.

We would, however, express the opinion that the simpler and the less liable to any evasion tax may be the better. In one city we were informed that out of some Rs. 5 lakhs to Rs 6 lakhs that should be collected from a corporation motor vehicle tax, only Rs. 2½ lakhs were actually received.

15. The general opinion given to us was that motor vehicle taxation should be provincial and not local with the proviso that local bodies who now draw revenue from motor vehicles would have to be compensated, if provincial were substituted for local motor vehicle taxation. This is in accord with the views of the Taxation Enquiry Committee. In some places, however, the opinion was expressed that the abolition of local motor vehicle taxation would be considered an interference with Local Self-Government and that the power to impose such taxation was of educative value to such bodies.

We admit the force of this contention, but in view of the majority of public opinion in accord with the principle of provincial as against local taxation, the probable financial benefits to local finances from a motor vehicle tax collected provincially, and the convenience of the motor owner,

we suggest to the Committee that it might recommend to local Governments the propriety of provincial motor vehicle taxation with the abolition of local motor vehicle taxation, as an ideal to be aimed at as soon as circumstances permit. The proposal was actually under consideration in Madras before our visit.

16. We further found a body of opinion which favoured the imposition of a petrol excise to take the place of all other taxation on motor vehicles, a proportion of this to compensate local Governments, and local authorities for loss of their motor vehicle taxation. Undoubtedly, such taxation has very great advantages:

(*i*) It would cost no more to collect than the present petrol excise.

(*ii*) It would be impossible of evasion at least until an alternative motor fuel is available.

(*iii*) It would be equitable as proportioning tax paid to the use made of the roads.

(*iv*) It would be indirect and not perhaps felt so much as a lump annual motor vehicle tax.

In theory we would endorse it, and with this most of those we met cordially agree.

17. In practice, however, difficulties would arise, *e.g.*, the rate of excise would have to be a flat one throughout all India, as the petrol excise is collected at source in Burma, and this rate would have to be calculated so as to compensate the province with the highest rate of motor vehicle taxation, either provincial or local, for its loss by abolition of such taxation. This would involve in the case of Madras an extra 6 annas excise on petrol, and this rate would probably be higher than other provinces would desire.

Further, an immediate increase of 8 annas per gallon (2 annas for Central Road Fund ; 6 annas for provincial tax) in the price of petrol would undoubtedly be resented by the public even if relieved of other taxation. Also, it is probable that some provinces may wish to retain power to tax motor vehicles on particular lines, *e.g.*, to tax motor buses lightly as being of public service, or to tax them heavily as destroying the roads. We therefore cannot *at present* recommend a unified system of motor vehicle taxation through petrol alone.

18. We have, however, been sufficiently impressed with the great advantages of such a tax to consider seriously the following suggestion made to us, that, in addition to the 2 annas increase in the petrol excise which we have proposed for a Central Fund, a further 2 annas should be added to the excise and distributed solely on the basis of the proportionate consumption of petrol among the provinces, as a form of provincial motor vehicle taxation. What use the provinces should make of any revenue so received would, of course, be a matter for consideration by provincial Governments. In Madras we were informed that it would probably be utilised to reduce the local and municipal taxation on motor vehicles. In some provinces it might suffice to abolish entirely such local taxation and, after providing compensation to local authorities for such abolition, leave a surplus to the local Government. In other provinces where local taxation is light, or justified by local circumstances, it might be utilised for general road purposes. But, in view of the opinions given to us, the

Committee might consider the suggestion to Local Governments that a proposed introduction of a provincial 2 annas petrol excise should have, as its object, the taxation of those motor vehicles which at present escape local taxation entirely or which are inadequately taxed, and that it should not be used to increase the burden on those motor vehicles which pay already adequate taxation. The local taxation of this last might be adjusted so that after the introduction of the proposed 2 annas provincial excise, they should not have to pay in all more than they are now paying.

We do not, of course, suggest that provinces should be compelled to adopt such taxation, but the scheme appears to us to provide a very satisfactory form of provincial motor vehicle taxation, while preserving the local Governments' right either to impose further provincial taxation where desirable or to leave with local bodies the power of motor vehicle taxation for the present. We would suggest, however, that if local Governments leave to local authorities this power, it should be only up to maxima fixed on the conditions of each local authority, and with the proviso that all the proceeds of such taxation should be devoted to roads. Further, as it is so generally admitted that provincial motor vehicle taxation is preferable to local, no further extension of powers to tax motor vehicles should be made to local authorities and that when and if finances permit, local motor vehicle taxation should be entirely abolished and local authorities compensated.

For the present, we admit that varying rates of local motor vehicle taxation may be justified as it is not unreasonable that a car using the good roads in large cities should pay more than one running on bad roads upcountry.

19. We note that any form of taxation by petrol excise will not affect the motor vehicle propelled by steam or electricity. We therefore propose that if the suggestion of either a Central Fund or additional provincial taxation from petrol be adopted, equivalent taxation should be imposed on such motor vehicles as do not use petrol. The number of these will not, as far as we know, be very great and, for simplicity, we suggest that any such countervailing taxation should be provincial and imposed by the provinces and should be sufficient to give such vehicles no advantage over petrol-driven vehicles.

We have not discussed the exact form such taxation should take, but we may in passing suggest that one of the functions of the Central Road Board might well be the co-ordination of statistical and other information regarding motor vehicle taxation in order to attain, as far as possible, uniformity among the provinces, whom it could advise on such questions.

20. As regards road users other than motor vehicles, it was suggested to us that bullock carts do considerable damage to roads, and that all such vehicles, including horse-drawn vehicles, should pay a small annual tax to local authorities, such as District Boards. (In many municipalities they already pay a wheel tax.)

It was pointed out to us, however, that, where tolls exist, bullock carts, etc., contribute to road upkeep. But where tolls are not in force, we agree an annual tax on such vehicles appears fair—possibly with a heavier scale for hired carts than for the cultivator, or even with exemption for the cultivator or for those who contribute to local cess. Owing to the varied systems of land tenure in India, the details of course would have to be left to local Governments, and possibly public opinion is not yet ready for such a tax. We suggest however that the Committee might recommend

such taxation, as we found far more opinion in support of it than we expected.

It was also suggested to us that the narrow iron tyres normally fitted to the bullock cart, and the excessive load per square inch thereby imposed on the surface of the road, were responsible for much of the damage done, and that, therefore, endeavour should be made to enforce a wider width of tyre which should do less damage. It was suggested that tax on bullock carts should differentiate between carts with tyres of a certain minimum width which should escape more lightly than those of the ordinary type. The suggestion is commendable, and we are of opinion that it might be possible to enforce it in municipal areas. But we have doubts whether in the bulk of the country-side such taxation could be either enforced or collected without considerable harassment to the cultivator.

21. We had various other suggestions made to us as to raising additional funds for roads, and of these the following were the most important:—

Tolls.—The general opinion (with which we strongly agree) is that they are undesirable on roads but justifiable on bridges, to go towards the cost of construction. We see no objection to a toll on a new bridge which replaces a ferry, but we suggest that road tolls are a hindrance to transport of every kind and should be abolished as soon as funds allow.

Another suggestion made to us was that provincial Governments or local authorities should be empowered to grant monopoly licences for motor transport, both of passengers and goods, on specified routes under strict conditions of service, etc. On the Pandu Ghat-Shillong road such a monopoly has been granted and brings a revenue of about Rs. 2 lakhs a year. But we received complaints of the high rates charged, and economically such monopolies are generally considered unsound.

It was however urged that such monopolies would produce efficient services, which are impossible under the present cut-throat competition, and that the proceeds of such monopolies would afford great assistance towards road work. We were informed in the Central Provinces that offers had been received by District Boards whereby a private company would construct a road in return for a 5 years' monopoly.

We do not like the idea of monopoly, but admit the method may be justifiable under certain conditions and needs further exploration.

22. It was also suggested to us that local authorities responsible for upkeep of roads should be empowered to issue licences for the plying of public vehicles for hire. Provided the proceeds be spent on roads, this appears justifiable, and it is, we believe, the practice in most countries that the proceeds of such licences go to the local authorities. In the absence of any suitable technical staff with local authorities, it would be necessary however for the Police to retain control over the grant of licences and the running of vehicles, to prevent danger to the public from unsuitable or unsafe motor buses, etc. Provincial Governments should however be able to elaborate a scheme to enable local authorities to draw revenue from such services with due regard to the public safety.

23. It was also suggested to us that District Boards should be allowed to levy a terminal tax on goods imported or exported into the Board's jurisdiction by rail or steamer, in order to raise money for roads. This

appears to us to be a matter of general local taxation and we doubt whether such could be justifiably or successfully earmarked for roads.

This also applies to a suggested surcharge on income tax.

24. It was also suggested to us that Railway Companies should be compelled, or at least permitted, to contribute to the cost of building or maintaining feeder roads which bring traffic to their stations. *Prima facie,* considering the condition of many feeder roads to railway stations in this country, we are of opinion that the suggestion seems reasonable, and we recommend that the Committee might discuss the matter with the representatives of the Railway Board in Delhi.

We have not in our tour considered the question of roads in territories administered by the Government of India or what contribution, if any, the Army Department ought to make towards the cost of roads which are either entirely or partially of strategic value. Such do not appear to fall within the purview of the Sub-Committee.

25. For the purpose of supplementing provincial finances for roads (apart from the contribution from a Central Road Fund as set out in Part II of this Report), we suggest—

(*a*) Provincial motor vehicle taxation in the shape of a further 2 annas excise on petrol collected centrally and distributed on the consumption basis to the provinces.

(*b*) Provincial motor vehicle taxation to take the place of local motor vehicle taxation and road tolls on motor vehicle, where the 2 annas petrol excise referred to in (*a*) above may not provide sufficient revenue.

(*c*) Further local taxation, which we consider might include

(*i*) taxation of all vehicles other than motor vehicle;

(*ii*) tolls on bridges ;

(*iii*) proceeds of licence fees for public service motor vehicles ; and

(*iv*) in exceptional cases, grant of monopoly transport concessions.

PART IV.

26. We have not considered at length what should be the composition of the Central Advisory Road Board as that must depend upon the work allotted to it. But as considerable interest was shown in what was likely to be its composition, we have been unable to avoid making reference to the point. But a fairly general suggestion appeared to be that it should consist of :—

(*i*) representatives of the Legislature,

(*ii*) representatives of the Departments of the Government of India concerned, including the Army Department,

(*iii*) a representative of the Railway Board,

(*iv*) the Consulting Engineer to the Government of India, and

(*v*) a whole-time Road Expert with a permanent Secretary possessing technical knowledge.

It was suggested to us by some that the Central Road Board should be a step in the direction of an eventual Ministry of Transport with large executive powers. We are not in a position to give a definite recommendation on this matter but leave the suggestions for the consideration of the Committee.

PART V.

27. To summarise, we are of opinion, from the information so far received, that the development of the Indian road system can be best attained by the following methods :—

(*i*) the formation of an Advisory Central Road Board, and of Road or Communications Boards in each province;

(*ii*) some uniform classification of roads on some such lines as all-India roads, provincial roads, district roads and village roads;

(*iii*) the formation of a Central Road Fund, which shall primarily contribute to the improvement of all-India roads, and thereby release some provincial funds for other roads;

(*iv*) the more important inter-district roads should be provincialised and the remainder, *e.g.*, feeder roads, be classed as district roads and be left to District Boards and Councils;

(*v*) further funds for road development should be raised

(1) by an additional petrol excise of 2 annas for a Central Road Fund;

(2) by a further additional petrol excise of 2 annas for provincial purposes;

(3) by provincial motor vehicle taxation involving the abolition of local motor vehicle taxation ; and

(4) by additional local taxation as suggested,

with the provisos that—

(*a*) general revenues can be reasonably expected to contribute to roads, and any fresh funds now raised should be spent in addition to the amount already spent on roads.

(*b*) the Central Government should at the first possible opportunity devote at least part of the present four annas petrol excise as additional funds for road development;

(*vi*) as the great need of many Indian roads is bridges and reconstruction on modern lines, bridging and such re-construction as can be properly considered capital expenditure, should be undertaken from loan funds as early as possible;

(*vii*) for this purpose, a statutory Road Fund should be initiated to provide a source to meet interest and sinking fund charges on loans;

(*viii*) as the great majority of roads in India are unmetalled, the most urgent object for research is into improved methods of *kachha* road making.

We suggest therefore to the Committee that consideration might be taken of these views in examining the problems presented by the terms of reference.

28. In conclusion, we desire to place on record our appreciation of the help we have received from the local Governments in discussing with the Sub-Committee matters of considerable intricacy at very short notice. We also wish to place on record our appreciation of the time freely given

and of the trouble taken by various public bodies, non-official associations and many private individuals, who appeared before the Sub-Committee and gave us the benefit of their many and interesting views on this important subject.

We are greatly indebted to our Secretary, Mr. H. F. Knight, and to Mr. K. G. Mitchell, our Technical Adviser, for their invaluable help to us on our tour. Under considerable pressure of work, owing to the short time allotted to us in which to tour the provinces, they have displayed the greatest keenness in assisting us in every respect.

We think that this Report indicates the general trend of opinion throughout India so far as we were able to ascertain it.

A. H. FROOM, *Chairman.*

M. SUHRAWARDY.

GANGANAND SINHA.

BOMBAY,

Dated the 23rd December 1927.

Supplementary Report on the Punjab.

The Sub-Committee arrived at Lahore on the morning of January 9th, 1928 and stayed there till the night of January 12th. Kumar Ganganand Sinha had notified that he would be unable to join the Sub-Committee, and did not accompany us to Lahore. On the 9th, the Punjab Government had arranged for the Sub-Committee to view various classes of roads in the vicinity of Lahore and a tour of over a hundred miles was made by road. In the Punjab, roads have been reclassified into "arterial roads", "main roads" and "other roads". Arterial roads are maintained by Government through the agency of the Public Works Department. Main roads are maintained by District Boards with grants from Government of varying percentages calculated on the circumstances of the individual Boards. Other roads comprise the less important district roads and are maintained entirely from District Board Funds. The Sub-Committee traversed sections of all these roads and also of the canal inspection roads which are not open to heavy traffic. From Lahore to Amritsar was an example of—

(*a*) how motor passenger traffic can compete with a parallel line of railway. We were informed that the railway passenger traffic between Amritsar and Lahore has fallen by about 50 per cent. in the last year or so owing to the competition of motor bus service;

(*b*) the destructive effect of motor bus traffic on road surface.

The Sub-Committee also traversed a line of road recently reclassified as arterial and now under construction as a metalled road with various experimental surfaces. This suggested the necessity of further research into road construction in India. The fact that motor bus services sprang up as the road bed was constructed, and even before it was metalled, is another proof of the tremendous demand for passenger transportation in India and of its value to the agriculturist.

2. The Sub-Committee discussed development of roads with the following officials and non-officials—

The Hon'ble Sardar Jogendra Singh, Minister for Agriculture, Government of the Punjab,

Mr. H. W. Emerson, C.I.E., C.B.E., I.C.S., Chief Secretary to the Government of the Punjab,

Mr. A. R. Astbury, C.I.E., I.S.E., Chief Engineer and Secretary to the Government of the Punjab, P. W. Department (Buildings and Roads Branch),

Mr. S. G. Stubbs, O.B.E., I.S.E., Secretary, Communications Board, Punjab

Pir Sayad Mohammed Hussain, M.L.C.,

The Hon'ble Rai Bahadur Lala Ramsaran Das, C.I.E., representing the Punjab Chamber of Commerce,

Mr. R. E. Grant Govan, representing the Punjab Chamber of Commerce,

Mr. Owen Roberts, representing the Northern India Automobile Association and Northern India Chamber of Commerce,

Mr. D. J. HORN, representing the Northern India Chamber of Commerce, and in these discussions had the assistance of the following members of the Road Development Committee—

(1) Raja GHAZANFAR ALI KHAN, M.L.A.,
(2) The Hon'ble Sardar SHIVDEV SINGH UBEROI, and
(3) Diwan CHAMAN LAL, M.L.A.

Mr. W. S. DORMAN, Deputy Chief Engineer, Punjab, was present throughout.

3. Speaking generally, the Sub-Committee's conclusions as given in their Report on their tour in the other provinces of India were confirmed or otherwise as below :

The conclusions summarised in Part II of the Report :—

(*i*) We found in the Punjab some doubt at first as to the utility of a Central Road Board. It was feared that it would obtain executive powers and encroach upon provincial autonomy. But it was generally agreed that it would be of use in an advisory capacity for co-ordination and for research and especially as a means of keeping public opinion in touch with the necessity for road development in India.

(*ii*) The imposition of an extra two annas excise on petrol to form a central fund was objected to in certain quarters on the ground that petrol is already very expensive in the Punjab, owing to the high cost of freight from the ports and the selling charges of the oil companies. And it was urged that though petrol is produced in the Attock district of the Punjab, yet its price is kept up to the level of that of imported petrol. It was further urged that the Punjab motorist pays heavily in the freight demanded to bring his car up from the port and also in the Punjab provincial taxation. We think however that the imposition of a two annas petrol excise for a central fund would not excite such great opposition as to need the abandonment of the proposal made to us and accepted by all the other provinces.

(*iii*) The Punjab Government while prepared to consider other factors for division of the proceeds of such a central fund would urge most strongly that the principle of division should be based on the willingness of a province to help itself in road development by imposing provincial taxation and by spending a reasonable proportion of its revenues on roads ; and it was urged particularly that one of the factors must be the ratio of road expenditure to revenue.

(*iv*) That the proceeds should be spent primarily on roads of all-India or inter-Provincial importance was not taken exception to.

(*v*) That such expenditure must be additional to, and not in place of, the normal provincial expenditure on roads was emphasised very strongly.

(*vi*) The Punjab Government expressed considerable misgivings as to the policy of financing road development from loans inasmuch

as it involves meeting not only the interest and sinking fund charges over a period of years, but the maintenance charges as well, which might develop into a serious burden unless provided beforehand. It was agreed however that bridges might be constructed out of loans. (We consider what work should be constructed out of loans to be a matter which might safely be left to the provincial Government's own discretion.)

(*vii*) Some doubt was expressed as to the possibility of constituting a permanent Road Fund.

4. *Paragraph 25 of the Report* :—

(*a*) There is already fairly heavy provincial motor taxation in force in the Punjab and we did not get any clear indication as to whether the public would favour the imposition of a provincial two annas petrol excise as a substitute for all or part of this. The matter was left to be further considered by those whom we met.

(*b*) There are apparently only two road tolls in the province apart from tolls on boat bridges and ferries. The difficulties felt, for example in Madras, as regards local motor vehicle taxation and road tolls do not appear to exist here.

(*c*) (*i*) Taxation of vehicles other than motor cars—Opposition was expressed to the idea of taxing bullock carts.

(*ii*) Tolls on bridges were not objected to.

(*iii*) Proceeds of licence fees for public service motor vehicles—We had no opportunity of discussing this in detail.

(*iv*) Monopoly transport licences—Generally speaking, opposition was expressed to any attempt to restrict motor services in such manner though it was admitted that on one hill road strict control of motor vehicles was in force and imperative.

5. It appeared to us that the most striking feature of our visit to the Punjab was the active interest shown in the province in road development and the benefits which obviously follow in its train. It was urged upon us by all that development of roads was of primary importance to the agriculturist. We were told that where he had access to a good road, he was able to take his produce to a market town and get proper market rates for his produce, which he had formerly to sell at below market rates in his own village to the bania.

6. Again the convenience of travelling by motor bus as compared with travel by rail was stressed and we admit that unpleasant though such competition might be to the Railway Companies, it is in certain areas forming a very useful incentive for the improvement in accommodation for third class passengers and, as it was expressed to us, in the civility with which such passengers are treated by railway employees.

7. We understand that in the Lahore district it costs Rs. 3 to cart 100 c. ft. of road-metal for the first mile of a metalled road and Rs. 4 on an unmetalled road, and for the succeeding miles the rates are Rs. 1-8-0 and Rs. 2 respectively. 100 c. ft. of metal requires about four carts. It might therefore be argued that a metalled road probably saves the cultivator two annas a mile on every trip his cart makes. If account were taken of the

enormous mileage covered by cultivators' carts in moving crops to market, the financial saving to the country by a developed system of roads might perhaps be dimly guessed at.

8. A further point which struck us in the Punjab was the foresight with which the road programme is being planned and the rapidity with which it is being pushed on and it is an example which needs to be followed elsewhere in that the programme is mapped for years ahead and the future maintenance cost of the roads is kept in view all the time. At present the cost of maintaining roads in the Punjab is increasing at the rate of Rs. 10 lakhs a year and should future conditions so demand, the rate of progress would be adjusted according to the money available for maintenance.

9. In conclusion, we would thank the Punjab Government for our very interesting visit to the province and for the information supplied to us. We would also thank those gentlemen, official and non-official, who met us and discussed with us road development.

A. H. FROOM, *Chairman.*

M. SUHRAWARDY.

NEW DELHI,

Dated the 13th January 1928.

APPENDIX III.

Statistical Statements.*

* Statements A to K have been compiled from the answers to the questionnaire given by local Governments and Administrations. In certain instances the figures have been amplified and modified as the result of subsequent correspondence.

STATEMENT A.

Road mileage according to classes and types in 1926-27.

Province.	Provincial.			Local.			Both classes.			Percentage of Provincial to both classes.	Percentage of surfaced to total mileage.	Remarks.
	Surfaced.	Unsurfaced.	Total.	Surfaced.	Unsurfaced.	Total.	Surfaced.	Unsurfaced.	Total.			
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.			
Madras	3,590	530	4,120	17,850	2,760	20,610	21,440	3,290	24,730	16·6	87·0	
Bombay Presidency	*5,940*	*760*	*6,700*	*2,790*	*8,180*	*10,970*	*8,730*	*8,940*	*17,670*	*37·7*	*47·4*	
Sind	*60*	*1,520*	*1,580*	*40*	*10,830*	*10,870*	*100*	*12,350*	*12,450*	*14·5*	*0·8*	
Bombay and Sind	6,000	2,280	8,280	2,830	19,010	21,840	8,830	21,290	30,120	27·4	29·3	
Bengal	890	570	1,460	2,510	15,450	17,960	3,400	16,020	19,420	7·5	17·5	
United Provinces	3,170	700	3,870	4,540	26,970	31,510	7,710	27,670	35,380	10·9	21·8	
Punjab	1,870	920	2,790	1,130	19,020	20,150	3,000	19,940	22,940	11·8	12·7	
Burma	2,720	7,210	9,930	480	1,700	2,180	3,200	8,910	12,110	81·8	26·4	
Bihar and Orissa .. .	1,340	240	1,580	2,410	25,340	27,750	3,750	25,580	29,330	5·4	12 8	
Central Provinces	4,370	2,500	6,870	300	1,270	1,570	4,670	3,770	8,440	81·4	55·4	
Assam	400	3,270	3,670	160	5,540	5,700	560	8,810	9,370	37·2	6·0	
Minor Provinces and Administrations.	2,500	2,700	5,200	50	2,050	2,100	2,550	4,750	7,300	..	..	See Statement A-1.
Total ..	26,850	20,920	47,770	32,260	119,110	151,370	59,110	140,030	199,140	23·8	29·6	

Notes on Statement A.

Madras.—3,040 miles of surfaced roads in charge of district boards are here classed as "Provincial". These are trunk roads for which Government assumed financial responsibility in 1920-21. At present however the contribution from provincial revenues is at a flat rate of Rs. 500 per mile per year for maintenance whereas the average actual cost is Rs. 575 per mile per year. Including works of construction, the share of the cost of these roads borne by provincial revenues was, in 1926-27, 75 per cent.

Bengal.—From the Administration Report of the Public Works Department, Buildings and Roads Branch, for the year 1925-26 the total mileage of unmetalled roads is stated to be 34,270. The figures furnished in the reply to the questionnaire are less by some 18,250 miles. This difference is understood to represent roads maintained by union and village boards, complete information regarding which is not readily available.

Burma.—The reply to question A-I (*vii*) of the questionnaire gave the length of metalled roads in 1926-27 as 1,890 miles "Provincial", 330 miles "Local" or 2,220 miles in all. Subsequently the total figure was corrected to 3,200 miles but the classification of the revised figure was not stated. As time did not allow a further reference to the Government of Burma, the new figure has been split up in the same proportion as the old, while the total mileage of both types has been left as first stated.

Bihar and Orissa.—Under "Provincial" are included 67 miles surfaced and 45 miles unsurfaced maintained by the Public Works Department in Feudatory States.

Assam.—The figures given *exclude* 5 miles surfaced and 370 miles unsurfaced of "Central Civil" roads; and also 10 miles surfaced of "Imperial Military" roads.

STATEMENT A-1.

Road mileage according to classes and types in 1926-27.—Minor Provinces and Administrations.

Province.	Provincial.			Local.			Both classes.		
	Surfaced.	Un-surfaced	Total.	Surfaced.	Un-surfaced.	Total	Surfaced.	Un-surfaced.	Total.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
North-West Frontier Province ..	1,000	1,600	2,600	23	1,861	1,884	1,023	3,461	4,484
Delhi	140	Not stated	140	Not stated.		..	140	..	140
Baluchistan	(*a*) 190	(*b*) 1,070	1,260	..	..	..	190	1,070	1,260
Coorg	250	60	310	..	70	70	250	130	380
Ajmer-Merwara	270	10	280	30	110	140	300	120	420
Central India Agency	(*c*) 640	..	640	..	..	..	640	..	640
Total ..	2,490	2,740	5,230	53	2,041	2,094	2,543	4,781	7,324
Or, approximately .	2,500	2,700	5,200	50	2,050	2,100	2,550	4,750	7,300

Notes on Statement A-1.

(*a*) 93 miles "Central Civil". 97 miles "Military".

(*b*) 924 miles "Central Civil". 143 miles "Military".

(*c*) Includes roads maintained in States from Central Civil funds.

The figures regarding Government roads in the North-West Frontier Province have been compiled from the P. W. D. (Buildings and Roads) Administration Report for 1925-26, as the reply to the questionnaire dealt with district board roads only. Military and civil roads are included. The total figures are 1,098 miles metalled and 1,647 miles unmetalled, but these include certain station roads; excluding the latter the round figures given in this statement are a close approximation.

Figures for Delhi Province have been supplied with respect to "Provincial" metalled roads only.

It will be seen that the information available is incomplete. The figures may be taken as being reasonably correct with respect to surfaced roads; they are manifestly incomplete with respect to unsurfaced roads.

STATEMENT B.

Area, population and density of population.

Province.	Area (thousands of square miles).				Percentage of area cultivated.	Population (millions).			Density of population. Number of persons per square mile.	Remarks.
	Cultivated.	Uncultivated.	Forest.	Total.		Rural.	Urban.	Total.		
Madras	68·7	53·8	20·5	143 0	48	37·04	5·28	42·32	296	
Bombay Presidency ..	*52·3*	*10·8*	*13·9*	*77·0*	*68*	*12·02*	*3·98*	*16·00*	*208*	*Sub-division of area is only approximate.*
Sind	*14·5*	*31·5*	*0·5*	*46·5*	*31*	*2·70*	*0·60*	*3·30*	*71*	*Ditto.*
Bombay and Sind ..	66·8	42·3	14·4	123·5	54	14·72	4·58	19·30	156	
Bengal	44·5	25·2	7·2	76·9	58	43·50	3·20	46·70	608	
United Provinces ..	53·6	38·2	14·5	106·3	50	40 57	4·81	45·38	428	
Punjab	50·0	44·9	5·0	99·9	50	18·10	2·60	20·70	207	Ditto.
Burma	33·3	178·4	31·5	243·2	14	11·23	1 98	13 21	54	
Bihar and Orissa ..	47 9	23 5	11 8	83·2	58	32 63	1·37	34·00	410	Excluding Feudatory States.
Central Provinces ..	42·8	30·5	25·6	98·9	43	12·52	1·39	13·91	141	
Assam	15 0	39·5	7·0	61·5	24	7·73	0·26	7·99	130	Sub-division of area is only approximate.
Total ..	422·6	476·3	137·5	1,036·4	41	218·04	25·47	243·51	235	

STATEMENT C.

Distribution of road mileage according to area and population.

Province.	Mileage per 100 square miles of total area.			Mileage per 100 square miles of cultivated area.			Mileage per 100,000 of population.		
	Surfaced.	Unsurfaced.	Total.	Surfaced.	Unsurfaced.	Total.	Surfaced.	Unsurfaced.	Total.
	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.	Miles.
Madras	14·15	5 68	19·83	31·25	4·75	36·00	47·90	19·10	67·00
Bombay Presidency ..	*11·10*	*10·74*	*21·84*	*16·65*	*17·05*	*33·70*	*53·46*	*51·73*	*105·19*
Sind	*0·22*	*26·86*	*27·08*	*0·70*	*85 30*	*86 00*	*3·09*	*396·76*	*399·85*
Bombay and Sind ..	7·01	16·81	23 82	13·15	31·90	45·05	44·84	107·61	152·45
Bengal	4·40	20 90	25 30	7·60	36·10	43·70	7·30	34·30	41·60
United Provinces ..	7·30	26·30	33 60	14·30	51 80	66·10	17·00	61·00	78·00
Punjab	3·00	20 00	23 00	6 00	40 00	46 00	14·00	96·10	110·10
Burma	0·92	3·61	4 53	9 60	26·70	36·30	24·20	67·45	91·65
Bihar and Orissa ..	4·40	30·70	35·10	7 85	53 55	61·40	10·80	75·00	85·80
Central Provinces ..	4·68	3 80	8 48	10·90	8·60	19·50	33 60	27·10	60·70
Assam	0·92	14 94	15·86	3·75	58·60	62·35	7·07	114·99	122·06
Total ..	5·45	13·05	18·50	13·30	32·10	45·40	23·20	55·70	78·90

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STATEMENT D.

Expenditure on roads in 1926-27.

Note.—Grants from provincial revenues to local bodies for expenditure on roads are shown as provincial expenditure.

Province.	Provincial.				Local.				Total expenditure from revenue.			Total expenditure including capital.
	Construction.		Maintenance.	Total.	Construction.		Maintenance.	Total.	Construction.	Maintenance.	Total.	
	Capital.	Revenue.			Capital.	Revenue.						
	Rs (thousands).											
Madras	..	7,91	33,47	41,38	2,82	14,96	50,38	68,16	22,87	83,85	1,06,72	1,09,54
Bombay Presidency	*5,09*	*17,35*	*43,50*	*65,94*	..	*2,25*	*7,63*	*9,88*	*19,60*	*51,13*	*70,73*	*75,82*
Sind	..	*2,38*	*5,96*	*8,34*	..	*1,42*	*6*	*1,48*	*3,80*	*6.02*	*9,82*	*9,82*
Bombay and Sind	5,09	19,73	49,46	74,28	..	3,67	7,69	11,36	23,40	57,15	80,55	85,64
Bengal	..	7,54	22,13	29,67	..	10,84	25,68	36,52	18,38	47,81	66,19	66,19
United Provinces	25,83	7,14	33,58	66,55	..	6,95	25,42	32,37	14,09	59,00	73,09	98,92
Punjab	28,05	28,09	43,51	99,65	..	7,81	16,65	24,46	35,90	60,16	96,06	1,24,11
Burma	..	61,60	49,95	1,11,55	..	..	17,38	17,38	61,60	67,33	1,28,93	1,28,93
Bihar and Orissa	..	4,90	12,74	17,64	..	11,34	24,13	35,47	16,24	36,87	53,11	53,11
Central Provinces	..	20,14	34,66	54,80	..	1,75	2,62	4,37	21,89	37,28	59,17	59,17
Assam	..	2,78	17,00	19,78	..	3,98	6,32	10,30	6,76	23,32	30,08	30,08
Minor Provinces and Administrations	..	7,60	40,44	48,04	..	6	1,01	1,07	7,66	41,45	49,11	49,11
Total ..	58,97	1,67,43	3,36,94	5,63,34	2,82	61,36	1,77,28	2,41,46	2,28,79	5,14,22	7,43,01	8,04,80

Notes on Statement D.

Bombay and Sind.—Grants-in-aid of Rs. 14·16 lakhs in Bombay Presidency, Rs. 4·84 lakhs in Sind, or Rs. 19·00 lakhs in all, were paid to local bodies from provincial revenues, but information is not available as to the distribution of the expenditure of these grants between construction and maintenance. The amounts have been adjusted in this statement by inclusion under "Provincial" and deduction from "Local" in the proportion of the other expenditure distributed between these heads by the Bombay Government.

United Provinces.—The figure of expenditure on construction from provincial revenues includes Rs. 3·4 lakhs interest charges.

Bihar and Orissa.—The expenditure from local funds given in the reply to the questionnaire has since been ascertained to include Rs 6·03 lakhs grants-in-aid from provincial revenues. This sum has now been included under "Provincial" and excluded from "Local", the adjustment between construction and maintenance having been made proportionately to the figures first reported.

STATEMENT D-1.

Expenditure on roads in 1926-27.—Minor Provinces and Administrations.

NOTE.—No expenditure from capital is reported.

Province.	Provincial.			Local.			Total.		
	Construction.	Maintenance.	Total.	Construction.	Maintenance.	Total.	Construction.	Maintenance.	Total.
	Rs. (thousands).								
North-West Frontier Province ..	6,21	25,76	31,97 (e)	2	53	55	6,23	26,29	32,52
Delhi	49	1,88	2,37	Not stated.		..	49	1,88	2,37
Baluchistan	18 (a)	6,13 (b)	6,31	..	..	..	18	6,13	6,31
Coorg	..	1,51	1,51	..	10	10	..	1,61	1,61 (c)
Ajmer-Merwara	37	2,12	2,49	4	38	42	41	2,50	2,91
Central India Agency	35	3,04	3,39	..	..	..	35	3,04	3,39 (d)
Total ..	7,60	40,44	48,04	6	1,01	1,07	7,66	41,45	49,11

Notes on Statement D-1.

(*a*) "Central Civil".

(*b*) Rs. 2,76,000 "Military". Rs. 3,37,000 "Central Civil".

(*c*) Figures for construction and maintenance not separated in reply to questionnaire. Expenditure all presumed to be on maintenance.

(*d*) "Central Civil".

(*e*) Civil expenditure only. Military expenditure not stated.

Delhi.—See note on Statement A-1. No figures have been supplied of expenditure on (*a*) provincial unmetalled roads and (*b*) district board roads.

STATEMENT E.

Percentages of provincial, local and total revenues spent on roads, and incidence of road expenditure per head of population.

NOTE.—The expenditure taken is that of 1926-27, the revenue taken is the average of the years 1924-25, 1925-26 and 1926-27.

Province.	Percentage of revenue spent on roads.			Incidence of road expenditure per head of population.		
	Provincial.	Local.	Total.	Provincial.	Local.*	Total.
	Per cent.	Per cent.	Per cent.	Annas.	Annas.	Annas.
Madras	2·5	36·2	5·8	1·6	2·8	4·0
Bombay	4·4	15·6	5·5	5·0	1·2	6·7
Bengal	2·8	35·3	5·7	1·0	1·3	2·3
United Provinces	3·2	16·7	5·0	1·4	1·3	2·6
Punjab	6·5	23·0	7·9	5·5	2·2	7·4
Burma	10·1	29·0	11·0	13·5	2·5	15·6
Bihar and Orissa	3·2	24·4	7·3	0·8	1·7	2·5
Central Provinces	8·9	6·1	8·6	6·3	0·6	6·8
Assam	7·6	61·5	10·9	4·0	2·1	6·0
Total ..	5·0	24·8	7·0	3·0	1·7	4·5

*Calculated on rural population.

STATEMENT F.

Provincial and local expenditure on roads from revenue in the year 1913-14 and in the four years 1923-24 to 1926-27.

Province.	1913-14.			1923-24.			1924-25.			1925-26.			1926-27.			Expenditure index 1926-27. 1913-14=100.		
	Provincial.	Local.	Total.	Provincial.	Local.	Total.	Provincial.	Local.	Total.	Provincial.	Local.	Total.	Provincial.	Local.	Total.	Provincial.	Local.	Total.
								Rs. (lakhs).										
Madras	20·0	49·7	69·7	49·1	40·4	89·5	40·1	56·9	97·0	47·6	68·1	115·7	41·4	65·3	106 7	207	131	153
Bombay	24·8	14·6	39 4	47·0	22·3	69 3	63·3	21·7	85 0	53 3	27·9	81·2	69·2	11·4	80·6	278	78	216
Bengal	11·9	34·6	46·5	27·2	36·0	63·2	27·2	36·2	63·4	36·0	35·9	71·9	29·7	36·5	66·2	248	105	142
United Provinces..	19·1	24·2	43·3	31·4	29 0	60 4	39·6	27·6	67·2	34 5	33·3	67·8	40·7	32·4	73·1	214	133	168
Punjab	21·2	14·8	36·0	34·0	20·2	54 2	34·3	18·7	53·0	60·7	20 0	80·7	71·6	24·5	96·1	337	165	266
Burma	36·6	19·6	56·2	74·7	17·3	92·0	89·7	13·0	102·7	104·8	20·9	125·7	111·5	17·4	128·9	304	89	229
Bihar and Orissa	13·4	27·3	40·7	13·0	53·3	66·3	11·5	43·6	55·1	10·7	45·4	56·1	17 6	35·5	53·1	131	130	130
Central Provinces	28·3	3·8	32·1	31·3	..	..	37·9	3·1	41·0	43·0	5·0	48·0	54·8	4·4	59·2	193	114	183
Assam	41·0	16·2	57·2	17·1	7·4	24·5	16·5	8·3	24·8	17·4	9·3	26·7	19·8	10·3	30·1	48	64	53
Total ..	**216·3**	**204·8**	**421·1**	**324·8**	..	..	**360·1**	**229·1**	**589·2**	**408·0**	**265·8**	**673·8**	**456·3**	**237·7**	**694·0**	**210**	**116**	**164**

STATEMENT G.

Expenditure on road construction and maintenance from revenue in the year 1913-14 and in the four years 1923-24 to 1926-27.

Province.	1913-14.			1923-24.			1924-25.			1925-26.			1926-27.			Expenditure index 1926-27. 1913-14=100.		
	Construction.	Maintenance.	Total.	Construction.	Maintenance.	Total.	Construction.	Maintenance.	Total.	Construction.	Maintenance.	Total.	Construction.	Maintenance.	Total.	Construction.	Maintenance.	Total.
							Rs. (lakhs).											
Madras ..	19·9	49·8	69·7	15 2	74·3	89 5	17·4	79·6	97·0	28·0	87·7	115·7	22·9	83 8	106·7	115	167	153
Bombay ..	19·6	19·8	39·4	22·2	47·1	69·3	37·7	47·3	85·0	29·5	51·7	81·2	23·4	57·2	80·6	119	288	216
Bengal ..	17·7	28·8	46·5	15·2	48·0	63·2	15·7	47·7	63·4	21·9	50·0	71·9	18·4	47·8	66·2	104	166	142
United Provinces	12·9	30·4	43·3	10·4	50·0	60·4	11·5	55·7	67·2	11·0	56·8	67·8	14·1	59·0	73·1	109	194	168
Punjab ..	12·5	23·5	36·0	11·2	43·0	54·2	7·8	45·2	53·0	24·0	56·7	80·7	35·9	60·2	96·1	287	256	266
Burma* ..	14·8	41·4	56·2	31·3	60·7	92·0	47·0	55·7	102·7	55·3	70·4	125·7	61·6	67·3	128·9	415	162	229
Bihar and Orissa ..	21·5	19·2	40·7	32·5	33·8	66·3	23·1	32·0	55·1	25·0	31·1	56·1	16·2	36·9	53·1	75	192	130
Central Provinces†	13·4	18·7	32·1	..	..	..	13·2	27·8	41·0	16·0	32·0	48·0	21·9	37·3	59·2	164	200	183
Assam ..	42·1	15·1	57·2	3·0	21·5	24·5	3·6	21·2	24·8	4·7	22·0	26·7	6·8	23·3	30·1	16	154	53
Total ..	174·4	246·7	421·1	..	..	..	177·0	412·2	589·2	215·4	458·4	673·8	221·2	472·8	694·0	127	191	164

* All local fund expenditure assumed to be on maintenance.
Local fund expenditure for 1923-24 not available.

STATEMENT H.

Surfaced mileage in the year 1913-14 and in the four years 1923-24 to 1926-27.

Province.	1913-14.		1923-24.		1924-25.		1925-26.		1926-27.	
	Miles.	Index.	Miles.	Index.	Miles.	Index.	Miles.	Index.	Miles.	Index.
Madras	22,544	100	20,142	89	19,594	87	20,275	90	21,440	95
Bombay	6,628	100	8,584	130	8,655	131	8.720	132	8,830	133
Bengal	2,583	100	3,315	128	3,332	129	3,376	129	3,400	130
United Provinces ..	7,010	100	7,540	107	7,580	108	7,710	110	7,710	110
Punjab	2,615	100	2,650	102	2,932	112	2,945	112	3,000	115
Burma	2,300	100	2,672	116	2,890	126	2,947	128	3,200	139
Bihar and Orissa ..	2 599	100	3,528	136	3,614	139	3,697	142	3,750	144
Central Provinces ..	3,410	100	4,440	130	4,480	131	4,640	136	4,670	137
Assam	386	100	550	142	552	142	554	143	560	145
Total ..	50,075	100	53,421	106	53,629	107	54,864	109	56,560	113

STATEMENT J.

Present cost of annual maintenance and construction of roads in different provinces.

Province.	Maintenance.				Construction.			
	Surfaced.		Unsurfaced.		Surfaced.		Unsurfaced.	
	Provincial.	Local.	Provincial.	Local.	Provincial.	Local.	Provincial.	Local.
	Rs. per mile.							
Madras ..	950	363	66	90	..	..	..	..
Bombay ..	520	..	150	..	..	..	..	..
Bengal ..	2,250	..	370	..	10,000 to 30,000	..	..	..
United Provinces	750	420	200	20	..	..	..	..
Punjab ..	1,870	..	355	..	10,000 to 30,000	..	2,000 to 6,000	..
Burma ..	1,500 to 5,000	..	150 to 750	..	30,000 to 50,000	..	8,000 to 12,000	..
Bihar and Orissa	570		60		9,500		400	
Central Provinces	680		150		15,000 to 20,000	..	..	..
Assam ..	1,800	400 to 700	450 to 600	100	25,000	25,000	12,000 to 15,000	500 to 4,500

STATEMENT K.

Contributions from provincial revenues to local bodies for expenditure on roads in 1926-27.

Province.	For provincial or trunk roads.			For other roads.			Total.	Remarks.
	Construction.	Maintenance.	Total.	Construction.	Maintenance.	Total.		
				Rs. (thousands).				
Madras	2,40	13,10	15,50	2,23	14,79	17,02	32,52	Inspection by Government in case of first class or trunk roads and second class or district roads.
Bombay	1,77	88	*2,65	Separate information is not available.		19,00	21,65	* A few provincial roads in two districts are maintained by district boards at the cost of provincial revenues.
Bengal	..	..	..	..	..	..	..	Some provincial roads are maintained by district boards as a charge on provincial revenues. Figures not stated.
United Provinces ..	..	..	..	..	..	3,95	3,95	No supervision.
Punjab	..	..	..	7,60	7,12	14,72	14,72	Supervision of aided works and Class II road maintenance. Special staff.
Burma	..	..	..	..	..	..	..	A.-I. (*v*) of reply to questionnaire. Grants are made from provincial revenues for district board roads, but figures not stated.
Bihar and Orissa ..	..	..	..	..	..	6,03	6,03	Supervision by Superintending Engineers. Not shown in statement of expenditure in 1926-27 in reply to questionnaire.
Central Provinces ..	4,07	8,22	12,29	1,00	..	1,00	13,29	Supervision by Superintending Engineers.
Assam	Details not available.		1,76	Details not available.		6,53	8,29	There are no district boards in Assam. Some provincial roads are maintained by local boards with annual fixed grants given by Government. In addition to these grants, non-recurring grants are also given by Government to the local boards for improvement of their roads.
Total ..	..	..	32,20	..	..	68,25	100,45	

For the nine provinces the total provincial expenditure on roads from revenue was in the year 1926-27, Rs. 456·33 lakhs. Twenty two per cent of provincial road expenditure from revenues was thus spent through district boards and councils.

STATEMENT L.

Imports of motor vehicles, parts and accessories, and of tyres and tubes.

Year.	Motor cars (including taxi-cabs).			Motor cycles.			Motor omnibuses, motor vans and motor lorries.			Parts and accessories.	Rubber tyres and tubes.
	Number.	Value ex-duty.	Average value.	Number.	Value ex-duty.	Average value.	Number.	Value ex-duty.	Average value.	Value ex-duty.	Value ex-duty.
		Rs. lakhs.	Rs.		Rs. lakhs.	Rs.		Rs. lakhs.	Rs.	Rs. lakhs.	Rs. lakhs.
1913-14 ..	2,880	1,13	3,970	1,463	11	752	76	6	7,510	23	..
1919-20 ..	9,925	2,63	2,646	2,332	17	729	1,229	48	3,934	65	1,14
1920-21 ..	15,432	7,82	5,069	5,179	54	1,043	2,885	2,23	7,052	1,75	1,70
1921-22 ..	2,895	1,74	5,993	734	9	1,226	580	29	5,084	60	1,10
1922-23 ..	4,323	1,38	3,204	866	9	1.039	480	22	4,535	47	1,23
1923-24 ..	7,984	2,05	2,563	1,182	9	761	1,044	25	2,395	42	1,16
1924-25 ..	9,380	2,20	2,344	1,456	10	687	2,162	39	1,791	53	1,10
1925-26 ..	12,757	2,82	2,213	1,629	10	605	4,840*	88	1,822	68	1,65
1926-27 ..	13,197	2,94	2,229	1,803	10	581	6,343†	1,20	1,892	85	1,56
1927-28 ..	15,122	3,54	2,340	2,146	12	557	8,682‡	1,49	1,722	101	2,19

* Of these, 626, average value Rs. 2,407, were complete with bodies, and 4,214, average value Rs. 1,733, were chassis.
† Of these, 998, average value Rs. 2,360, were complete with bodies, and 5,345, average value Rs. 1,804, were chassis.
‡ Of these, 1,270, average value Rs. 2,148, were complete with bodies, and 7,412, average value Rs. 1,649, were chassis.

STATEMENT M.

Production, consumption and retail price of petrol in India.

Year.	Total production in India.	Quantity exported from India.	Quantity consumed in India.	Price per gallon* including excise (at Calcutta).
				Rs. A. P.
		Gallons (thousands).		
1913-14 ..	26,000	21,500	4,500	1 0 0
1919-20 ..	47,268	36,223	11,045	1 12 6†
1920-21 ..	33,226	18,857	14,369	1 8 6
1921-22 ..	38,642	20,156	18,486	1 14 0
1922-23 ..	37,922	19,789	18,133	1 14 0
1923-24 ..	34,045	16,672	17,373	1 11 0
1924-25 ..	43,088	22,059	21,029	1 11 0 to August 1924. 1 8 0 to Decr. 1924. 1 8 6 to March 1925.
1925-26 ..	38,868	8,140	30,728	1 6 6‡
1926-27 ..	40,779	2,219	38,560	1 6 6 to July 1926. 1 5 6 to Novr. 1926. 1 4 6 to March 1927.
1927-28 ..	49,683	3	49,680	1 2 6 to April 1927. 1 1 6

* Bulk price is one anna per gallon less.

† Includes excise duty of annas six per gallon imposed from 16th February 1917.

‡ Excise duty reduced to annas four per gallon from 1st April 1925.

STATEMENT N.

Duty on motor vehicles etc., and on motor spirit.

Year.	Motor cars (including taxi-cabs).		Motor cycles.		Motor omni-buses, vans and lorries.		Parts and accessories.		Rubber tyres and tubes.		Motor spirit.				Total revenue.
	Import duty.	Revenue.	Import duty.	Revenue.	Import duty.	Revenue.	Import duty.*	Revenue.	Import duty. †	Revenue.	Import duty.	Revenue.	Excise duty.	Revenue.	
	Ad.val. p. c.	Rs lakhs.	*Ad.val.* p. c.	Rs. lakhs.	*Ad val.* p. c.	Rs. lakhs.	*Ad. val.* p. c.	Rs. lakhs.	*Ad. val.* p. c.	Rs. lakhs.	Per gallon. As p.		Per gallon. As. p.	Rs. lakhs	Rs. lakhs.
1913-14 ..	5	6	5	..	5	2	5	1	5	..	1 6		..	..	9
1919-20 ..	7½	20	7½	1	7½	4	7½	5	7½	9	7 6‡		6 0	41	80
1920-21 ..	7½	56	7½	4	7½	17	7½	13	7½	13	7 6‡		6 0	54	157
1921-22 ..	20	35	20	2	11	3	20 & 11	12	20 & 11	22	7 6‡		6 0	61	135
1922-23 ..	30	42	30	3	15	3	30 & 15	14	30 &15	37	8 6‡		6 0	65	164
1923-24 ..	30	61	30	3	15	4	30 & 15	13	30 & 15	35	8 6‡	Negligible.	6 0	65	181
1924-25 ..	30	66	30	3	15	6	30 & 15	16	30 & 15	33	8 6‡		6 0	79	203
1925-26 ..	30	85	30	3	15	13	30 & 15	20	30 & 15	50	4 0		4 0	77	248
1926-27 ..	30	88	30	3	15	18	30 & 15	25	30 & 15	41	4 0		4 0	96	271
1927-28 ..	20	71	20	2	15	22	20 & 15	20	15	32	4 0		4 0	124	271

* The higher rates apply to parts and accessories of motor cars and motor cycles.

† The higher rates apply to pneumatic tyres and tubes.

‡ Includes 6 annas excise duty.

Note.—The import duties on lubricating oils in the above years were :—In 1913-14, 5 per cent *ad valorem*. From 1919-20 to 1925-26, 7½ per cent *ad valorem*. From 1926-27, 1a. 4p. per imperial gallon.

APPENDIX IV.

Progress made in India with improved forms of road surfaces.*

Opportunity has been taken to ascertain what has been done in recent years in different parts of India with improved forms of road surface. An enquiry addressed to all provinces has produced the following information.

MADRAS.†

With increased traffic and the introduction of motor bus and lorry services, improved forms of road surfacing became a necessity, as the ordinary water-bound macadam roads get disintegrated very soon and require constant repairs and frequent renewals. The improved forms adopted in the Madras Presidency are :—

(1) Spraying or surface painting on water-bound macadam road with tar or bitumen.

(2) Tar or asphalt macadam.

(3) Tar or asphalt grouting.

Tar spraying.—Of the above, item (1), tar spraying is the one generally adopted as it is easily done. The specifications laid down for surface tarring and tar macadam are the specifications Nos. 1 and 2 of the Roads Department, Ministry of Transport, England. The minimum thickness of metal coat on which surface tarring is done is 3″. After the consolidation of metal the road is usually allowed to settle under traffic for a month or so. The surface is then brushed well and tar is applied with a spraying machine. After the initial coat a second coat is applied in 12 months. Subsequent tarring is done in patches when and where there is need, and for purposes of estimate it may be taken to be required once in two years where the traffic is heavy. The cost of surface tarring on a new 3″ metal (granite) coat at Madras is Rs. 8,320 per mile of 18 feet roadway as detailed below :—

		Rs.	
3″ granite coat at Rs. 6 per 100 sq. ft.	..	5,702	
Tarring at Rs. 2-12-0 per 100 sq. ft.	..	2,614	
		8,316	or 8,320
The cost of maintenance per mile per annum at Rs. 2-12-2 or Rs. 1-6-0 per 100 sq. ft.		1,307	or 1,300

Surface painting with bitumen.—Like tar spraying, bituminous surfacing is done on a new metal coat after it has been opened for traffic for some time to allow for any local settling. Bituminous surfacing has come to be adopted only recently and the substance used is spramex. The cost of this form of surface will be about the same as that of tar spraying.

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* Compiled by Mr. K. G. Mitchell, Technical Adviser, from notes furnished by various road authorities.

† Note by the Chief Engineer, Public Works Department, Madras

Asphalt grouted macadam.—Where the traffic is exceptionally heavy asphalt grouted macadam (penetration system) is adopted. This consists of :—

(*a*) Bottom layer (3″ or 4″ thick) of stones 2″ to 2½″ gauge dry rolled, upon which hot asphalt is uniformly applied at the rate of 1·5 to 1·75 gallons per square yard.

(*b*) Intermediate layer of stones ¾″ to 1″ gauge dry rolled, over which a seal coat of asphalt is applied at the rate of 0·5 to 0·75 gallon per yard.

(*c*) Fine chippings spread and broomed on the surface and well rolled.

(*d*) In addition to the above a thin layer of sand spread over the chippings after they have been rolled in gives better results. This thin layer of sand is also rolled and any surplus removed after two weeks of traffic.

It is anticipated that under heavy traffic conditions this form of road surface will be economical in the long run. With the renewal of the seal coat say once in 3 years, the life of the asphalt grouted macadam is roughly estimated at 12 years.

BOMBAY.

Public Works Department.*

The Chief Engineer states that the asphalt work done on the Bandra-Ghodbander road, described below, has been very successful. He also states that a good deal of surface treatment has been done and is being done in Poona and elsewhere, and that experiments are being started with 'Colas', 'Mexaco' and 'Colfix' but that no results can yet be deduced from these experiments. He also draws attention to the economies effected by the Bombay Municipality by the use of improved road surfaces.

Bandra-Ghodbander Road. Section from Bandra to Andheri.

Previous history.—The Development Department was in charge of the road from 1920 to 1925. To meet the growing needs of traffic, the road was widened from 16′ to 30′ from Andheri to Santa Cruz and from 16′ to 40′ from Santa Cruz to Bandra. The surface was improved in 1921-22 by providing 8″ of rubble soling and 6″ of water-bound macadam. To remove the dust nuisance, tar carpeting was provided for the whole length of the road in 1923-24.

The heavy motor lorry traffic soon broke up the carpeted surface and when the Public Works Department resumed charge of the road in April 1925, the road surface was in a deplorable state and motoring on the road was very difficult and annoying, if not positively dangerous. Serious complaints were received from the public and the problem of repairing the surface was a very pressing one.

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* Letter, dated July 4th, 1928, from Mr. D. R. H. Browne, Chief Engineer, Public Works Department, Buildings and Roads Branch, Government of Bombay.

It was first proposed to lay a small length of asphalt macadam in the worst portion. A length of 1,400 ft. was laid in the cold weather following the monsoon of 1925 and was found very satisfactory. The condition of the remaining section, however, had further deteriorated and remedial measures were urgently required. Mr. K. S. Framji, the late Chief Engineer, Roads and Buildings, was therefore requested to visit the road which he did in January 1926, and funds for asphalting about 2 miles of the road were promised. The work was vigorously pushed on and by May 1926 about 11 furlongs were completed. In the meanwhile, it became apparent that it was not possible to neglect the remaining section of the road and an estimate for repairing it was submitted to Government. Funds were duly received and the whole road was completed in April 1927.

The cost of treating the whole length of $5\frac{1}{2}$ miles from Mahim causeway to Andheri is Rs. 3,45,000.

Petroleum asphalt from the Standard Oil Company has been used throughout the road, with the exception of 2 furlongs 1/1 and 0/8. In the former, Mexphalte and Spramex of the Asiatic Company and in the latter natural Trinidad asphalt with suitable flux oil have been used. The working rate with "Socony" and Mexphalte was Rs. 3-1-6 per square yard and that with Trinidad asphalt was Rs. 3-10-6 per square yard.

The surface treated with petroleum asphalt, "Socony" or Mexphalte shewed uniformly good results. The Trinidad asphalt surface, which was laid in February 1927, had to be partly seal-coated soon after the rains.

Central Circle, Bombay Presidency.

Note by the Superintending Engineer, Central Circle, giving a short account of the condition of roads and the progress made to date with improved forms of road surfaces in his Circle.

Most of the roads in this Circle are of long standing and were constructed to meet the traffic conditions which existed in the last century. As fast motor traffic increases and loads become heavier, they are found to be unsuitable for traffic under modern conditions and the result is that the roads deteriorate rapidly, and as the funds provided for their maintenance are insufficient to deal with the extra and more frequent repairs required, their condition is rapidly going from bad to worse. The sub grade for these roads is murum 6″ to 9″ thick with a coat of metal 3″ to 6″ thick. The metal is water-bound, the rolling being usually done with an 8 to 10 ton steam roller; though in many lengths the rolling has, owing to inadequate funds, still to be done with the old-fashioned bullock roller. In lengths that have been made or reconstructed recently the sub grade is a 9″ to 12″ layer of hand-packed rubble soling. The surface is a 6″ coat of water-bound macadam. Here too, though the sub grade does not give trouble, the surface does, being found unsuitable to withstand modern fast moving traffic.

Need for a surface that will stand modern traffic conditions has been recognized for some time past. Comparatively little has, however, been done so far in this direction owing to the financial situation. Nearly three miles of road in and around Poona have been treated with asphalt, while the work of asphalting the road from Ahmednagar to Ahmednagar station and that from Nasik to Nasik Road station is in progress and proposals to asphalt

roads in and around Poona and several important portions of roads in other Divisions in this Circle are under serious consideration of Government.

The asphalting done up to date in the Poona Division has been by what can be termed '$1\frac{1}{2}$" penetration method'. Briefly it is as follows :—

Wet rolling over metal is done in the ordinary way and when the metal is firm and dry, a layer of sand is brushed over the same to fill the interstices between the metal thereby reducing the penetration and quantity of asphalt required. Over this asphalt is poured (9 gallons per 100 sq. ft. approximately or 9/11ths of a gallon per square yard). Sand is then spread over it and the surface again rolled. The overall cost of this per 100 sq. ft. comes to Rs. 17 nearly. This method appears to be the cheapest satisfactory process of asphalt treatment in view of the present financial stringency. For portions of roads requiring preferential treatment what is termed '3" penetration method' is proposed to be adopted. For this method, metal is rolled *dry* to admit of greater penetration and the quantity of asphalt used including that required for the seal coat is 2 gallons per square yard approximately. The overall cost of this method works out for Poona Division to Rs. 28-8-0 per 100 sq. ft. nearly.

Bombay Improvement Trust.*

The types of surfaces laid by the Improvement Trust and the areas of each type constructed with the cost thereof are tabulated below :—

Type of surface.	Area laid sq. yds.	Cost.	Average rate.	Remarks.
		Rs. (lakhs).	Rs. A.	
1. 3" sheet asphalt pavement.	2,96,000	20·85	7 0 sq. yd.	Provided for first class roads subject to heavy pneumatic and iron-wheeled traffic.
2. $2\frac{1}{2}$" to 3" asphaltic concrete.	37,000	2·20	5 12 sq. yd.	Provided for second class roads subject to heavy traffic.
3. 3" asphalt penetration with a seal coat.	10,000	·35	3 8 sq. yd.	Do.
4. 1" Mexphalte pavement	1,34,000	3·26	2 8 sq. yd.	Provided for roads with medium traffic.
5. Spramex surfacing ..	60,000 roughly.	·60	1 0 sq. yd.	Provided for roads carrying light traffic and passages.

* Note by Mr. T. R. S. Kynnersley, M. Inst. C.E., Chief Engineer.

The Improvement Trust has not laid any portion with a concrete surface though concrete is adopted for the foundation.

Foundations.—The sub grade is carefully prepared and rolled with a roller of not less than 8 tons finishing with a 15 ton road roller, giving the surface a smooth, compact and uniform appearance.

For all important roads constructed during the last 5 years and treated with asphalt the foundations consist of a 6″ thick layer of 1 : 3 : 6 cement concrete with diamond shaped marks in the surface for proper bond with the pavement above, and reinforced when the sub grade is poor. In case of some of the old roads which were already completed as macadam roads with 10″ compact rubble packing and 6″ consolidated metalling, the asphalt surface has been laid directly on the old surface.

Cost of road foundations.

	Rs.	A.	P.	
(*a*) Cost of 6″ thick cement concrete foundation	4	0	0	sq. yd.
(*b*) Do. with reinforcement	4	8	0	sq. yd.
(*c*) Cost of macadam road foundation (10″ rubble packing and 6″ metalling) ..	4	6	0	sq. yd.

The aggregate for cement concrete is a mixture of 1½″ and 2½″ blue stone metal in equal proportions. The concrete is usually machine mixed and laid on the alternate bay system.

Surface treatments.—These can be divided broadly into two groups, the first three being for heavy traffic roads and the last two for light traffic roads. And selection is made in each group according to the nature and amount of traffic ; when the question of funds is the guiding factor preference would have to be given to the cheaper methods according to the money available.

Specification and brief description of construction.

The constituents of an asphaltic surface are stone chips, sand, filler and asphalt cement.

The chips are from blue stone from the Trust quarries having a granular structure, the largest size being 3/4″.

The sand is Juhu white sand suitably graded with stone dust to give the following ideal grading :—

	For heavy traffic.	For light traffic.
Passing 80 to 100 ..	.. 30 to 35 %	.. 20 to 25 %
40 to 50 ..	.. 40 to 45 %	.. 40 to 45 %
10 to 20 ..	.. 20 to 25 %	.. 30 to 35 %

Filler is required for making the pavement dense, and Portland cement is used for the purpose.

Asphaltic cement is natural asphalt brought to the required consistency by mixing when heated with the necessary quantity of flux oil. The amount

of pure bitumen in the Trinidad asphalt cement of the consistency used by the Trust is about 61 per cent.

Mixing and laying of the asphalt surfaces.

The materials for asphalt pavement have to be mixed in a regular asphalt plant, which has the following important parts:—(1) An engine for working the mixing plant consisting of a drying and heating drum with elevators and a mixing mill, (2) steam heating kettles and (3) boiler for providing steam for working the engine and for heating the kettles.

For fuel for the boiler, oil has been found to be excellent as the chances of over-heating of the materials with the consequent deterioration of the mixture are minimised and a constant pressure can be maintained with little manipulation and attendance.

Laying on road.—The pavements are to be laid in a uniform layer of the required thickness after cleaning the surface of all dust. The rolling has to be very carefully done with power-driven tandem rollers. A thoroughly trained staff is necessary for this work. In case of sheet asphalt, the binder course has to be followed with the surface course the same day to obtain complete adhesion and to avoid dirt, etc., being swept or blown on.

3" sheet asphalt pavement.—This is laid in two courses, the lower one being called the binder course and the upper one being called the wearing surface. The upper course which has to withstand the wear and tear of the traffic and the action of sun and rain is made dense and rich in bitumen, while the lower layer which acts as a stiffener is made of comparatively large sized materials and is not so dense and rich in bitumen.

2½" asphaltic concrete is laid in one course and is a modification of the two-course method based on utility and cost. It is midway between the two courses in consistency.

1" Mexphalte pavement is essentially an asphalt pavement, the only difference being that the bitumen employed is Mexphalte or Asphaltum which is cheaper than asphalt and contains 99% bitumen.

The details of the mixture which has given satisfactory results and is being used in every case at present are tabulated below :—

Materials per box of 600 lbs.

Description.	Ashpaltic cement.	Cement filler.	Sand.	Stone chips.	Penetration of A. C.	Per cent of bitumen.
	lbs.	lbs.	lbs.	lbs.		
Wearing surface course	122	40	438	..	25°	12·4
Binder course ..	45	*Nil*	120	435	25°	4·6
Asphaltic concrete ..	77	21	262	240	25°	7·8
1" Mexphalte	72	48	480	..	20° to 30° 40° to 50°	12·0

Mexphalte is generally laid on old macadam roads. Prior to laying Mexphalte the road is thoroughly swept and cleaned of all the dust and any irregularities made good by new metal well rolled. Just before laying the mixture on the surface it is painted uniformly with Spramex which is heated over-night and kept ready. The Mexphalte layer is then placed and well rolled as in the case of sheet asphalt pavement.

3″ asphalt penetration with a seal coat.—This surfacing is generally provided on macadam roads but can also be provided for road with concrete foundation. The macadam roads are completed with the first layer of 4″ consolidated metalling on the 10″ rubble foundation and are opened to traffic and allowed to consolidate for at least a year. The surface layer 3″ thick with asphalt penetration and a seal coat are then laid as below :—

All the irregularities in the old road surface are made good and the whole surface cleaned of all loose and foreign matter. Over this a 4″ loose layer of $2\frac{1}{4}$″ metal is laid uniformly and dry rolled with a roller not less than 10 tons, so that the metal is well interlocked but not broken. All irregularities appearing during rolling are remedied simultaneously, and care is taken so that this layer is entirely free of dirt and dust. On this rolled aggregate asphalt cement of the required consistency or Mexphalte of the necessary grade which is heated to a temperature of 320° to 330° is applied uniformly at the rate of $1\frac{1}{2}$ to $1\frac{3}{4}$ gallons per square yard by means of hand pouring pots with broad nozzle. The heated asphalt in the kettles has to be continuously stirred to avoid separation of the mineral matter in it, with consequent deterioration. The grouted surface when still hot is then covered up with a uniform layer of $\frac{3}{4}$″ chips and the surface well rolled till the pavement is thoroughly compact and interlocked. The surface is then swept clean of all loose material and then the second or the seal coat of the bitumen at the rate of $\frac{1}{2}$ to $\frac{3}{4}$ gallon is applied and the surface immediately covered with a uniform layer of grit and well rolled, after which the road can be opened to traffic. During the construction of this final layer, the road should be kept free of traffic as far as possible.

Spramex surfacing.—Spramex surfacing is similar in construction to the penetration method except that the bitumen is spramex, which instead of penetrating to 3″ to 4″ as in the latter case is applied just sufficient to coat the surface. The road has to be fully consolidated before spramexing is done. All the irregularities in the road surface are first made good and the surface cleaned of all dust. The first coat of Spramex is then applied at the rate of $\frac{1}{3}$ to $\frac{1}{2}$ gallon per square yard and $\frac{1}{4}$″ to $\frac{3}{8}$″ chips are spread over it uniformly and the surface rolled with a 10 ton roller till the chips are crushed and well interlocked in the interstices of the road bed. The excess material is then removed by means of brushes and a second coat of Spramex at the rate of 1 gallon per 6 square yards is sprayed uniformly and a layer of stone dust and sand is laid and properly rolled in.

Bombay Port Trust.*

Most of the Bombay Port Trust roads are made of water-bound macadam, a form of construction unsuitable for modern traffic and possessing the additional disadvantages of being dusty and requiring continual watering in the dry weather.

* Note by the Chief Engineer.

Experiments are being made with bituminous surfaces in an endeavour to find a reasonably economical road surface which will stand up to the extremely heavy wear to which all roads in the vicinity of docks are subjected but the experiments have not so far covered a long enough period to enable any definite conclusions to be reached.

The first departure from the practice of the use of either water-bound macadam or setts was in the construction of Manson Road.

As an experiment a portion of this road, about 400 feet long by 45 feet wide, was laid with reinforced concrete in 1923. The concrete foundation was made 6″ to 7″ thick and of 4 : 2 : 1 mix, the wearing surface was 2″ thick and of $1\frac{1}{4}$: 1 : 1 mix. The aggregate for the foundation was blue stone trap and gravel and that for the surface crushed granite. 'Ironite' was incorporated in a portion of the granolithic surface. The reinforcement was at the bottom of the slab and consisted of $\frac{1}{4}$″ diameter rods spaced at 6″ centres transversely and at 12″ centres longitudinally.

Work was started in January 1923 and the road was opened for traffic on April 13th, 1923. A census taken shortly after opening showed between 7 A.M. and 6 P.M. in one day 4,918 loaded bullock carts, 703 unloaded bullock carts, 11 loaded lorries and 13 unloaded lorries. The road has been in use now for nearly 5 years and the surface is in very fair condition. The weakest point is at the joints between the slabs. Wear at the joints was noticed not long after the opening of the road but it has not developed as seriously as was then feared would be the case. The expenditure on repairs has been negligible and watering has been dispensed with. After completion the surface was covered with tar and chips, but this soon wore off. A further small length of concrete road was subsequently constructed and opened for traffic on 12th March 1925. The specification was as for Manson Road with the following exceptions: the foundation was 8″ thick, blue trap sett stones curved on top and projecting slightly above the road were put in at the joints and the surface was treated with silicate of soda instead of with tar and chips. The transverse rows of blue stone setts can be distinguished. Some of these setts have become worn down or broken and may have to be replaced in the near future; the surface of the road is in excellent condition and nothing has been spent on repairs or watering. Owing to this road being very narrow the traffic on it is heavy and it was found impossible to keep it properly repaired as a water-bound macadam road.

The cost of this road worked out at Rs. 160 per 100 square feet of which Rs. 10-5-0 were for excavating and preparing the foundations. Owing to the difficulty of obtaining granite in Bombay some quays have been concreted with a surface containing an aggregate of blue stone trap. This appears to be wearing well and if used on concrete roads instead of granite would materially reduce the cost.

From the experience gained hitherto it appears that concrete roads stand the traffic very well if carefully constructed.

The commonest vehicle on the Port Trust roads is the bullock cart. The weight of a cart and driver (without bullocks) is about 10 cwts. The carts

are supposed to carry 16 cwts. but are often loaded to 20 cwts. The width of the steel tyre on each of the two wheels is 2¼" to 2½". The wheels are secured to the axles by cotter pins and owing to the large amount of play there is considerable grinding action on the road. The use of large lorries is increasing and these are often loaded well over their designed carrying capacity.

Note on the method of improving an old water-bound macadam road.*

The road referred to runs across the Mazagon Sewree Reclamation, it is about 2,400 feet long by 20 feet wide and it lies for most of its length in a depression, the land reclaimed on either side of it having been finished at a higher level than the road.

The road was built on the top of one of the bunds, which were constructed of murum to retain the clay and mud pumped in by the dredgers employed in the Mazagon Sewree Reclamation Scheme between 1907 and 1914.

One of the main storm water drains was also built on this bund, so it is now directly under the road. The road was constructed with the usual 9" of soling and about 6" of metal, but the surface of the road was not drained and consequently in the monsoon it was often partially submerged, and motor lorries and carts floundered along digging out pot-holes wherever the sub-soil or the surface became softened by the water. The road eventually became badly corrugated and pot-holed.

The traffic on the road has for some time been increasing and is now fairly heavy, probably about 25 lorries laden with 4 or 5 tons of iron, 50 laden bullock carts and 100 motor cars make double journeys over it daily.

Photo No. 1† shows the condition of the road before it was repaired, and photo No. 2† shows it partly repaired. The depressions were tested by straight edges—everything over 3" below the general surface level was considered to be a pot-hole—these were dug out to a diamond shape thoroughly cleaned and painted with tar, and filled in with tar macadam (1½" metal).

After the bad pot-holes had been repaired the corrugated surface of the road was attended to. This was brushed thoroughly clean and painted with tar, *i.e.*, sprayed by hand by means of watering cans of 2 gallons capacity. Tarred chipping ¾" gauge were then spread and raked on to the road. The average thickness of chippings was 1½"; ⅛" stone grit was spread on top of these chippings which were then rolled with a 1 ton hand roller. The surface was constantly tested with straight edges to ensure that it was uniform in plane. The carriage-way has been finished with a seal coat of bitumen. Various proprietory emulsified bitumens were used on test lengths, but the greater part is coated with Spramex applied hot.

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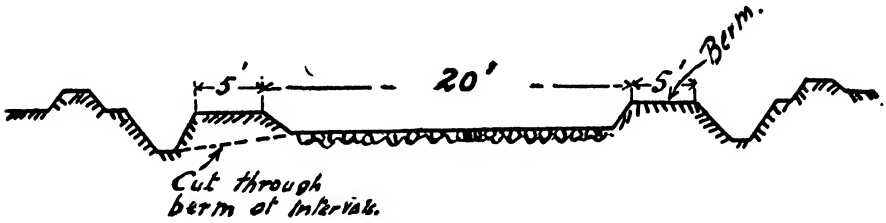
*Note by Mr. F. G. Carron, M.Inst.C.E., Executive Engineer, Construction.

†Not printed.

Drainage.—The surface drainage of the road has been assured by digging trenches parallel to the road on both sides of it as sketched;



These trenches are graded with a fall of 1 in 180 and discharge into gullies, which are connected to the main storm water drain under the road. Water is drained off the road through cuts in the berm, these cuts being made about 50′ apart.

Cost.—The actual cost of draining and repairing the road was Rs. 11-8-0 per 100 sq. ft. which includes the cost of forming the ditches and building gullies and connecting them to the main drain.

Tar to Road Board Specification No. 2 was used for the tar-macadam work.

The chips were mixed with tar in a *concrete* mixer at a depot about ½ a mile from the site and carted to the site as required.

BOMBAY MUNICIPALITY.

Note on the progress made with improved forms of road surfaces in the city of Bombay.

Before 1921-22 the only methods of resurfacing carried out were:—

(1) Water-bound macadam.
(2) Tar grouting.
(3) Surface dressing with 2 paint coats of tar.

These have now been replaced according to traffic requirements by the following:—

(1) 6″ sett pavement on 9″ cement concrete foundation.
(2) 3″ sheet asphalt on 6″ cement concrete and on existing consolidated water-bound or tarred road.
(3) 2″ asphaltic concrete on existing well consolidated water-bound or tarred road.
(4) 2½″ mixed macadam with ½″ mixed seal coat on 6″ cement concrete and on existing well consolidated water-bound or tarred road.
(5) 3″ asphalt macadam (penetration method) on 6″ cement concrete and on existing well consolidated water-bound or tarred road.
(6) 6″ cement concrete roads.
(7) Surface dressing with two paint coats of asphalt, chips and grit.
(8) Surface dressing with two paint coats of emulsified bitumen, chips and grit.

The present cost per square yard and the approximate mileage of the different types both before and after 1921-22 are as follows :—

Type.	Before 1921-22.		After 1921-22.		Remarks.
	Mileage.	Cost per square yard.	Mileage.	Cost per square yard.	
		Rs.		Rs. a. p.	
Water-bound ..	143	2	144	1 2 0	
Tarred roads ..	35	1	..	..	
Asphalt macadam ..	..	..	2	3 0 0	
Asphalt surface dressing	..	..	*37	1 0 0	*Of these about 5 miles represented ½" thick sand carpet.
Mixed macadam ..	..	..	2	4 0 0	
Asphaltic concrete ..	.	..	2	4 8 0	
Cement concrete ..	..	..	0·5	5 4 0	
Sheet asphalt ..	..	..	18	6 4 0	
Sett pavement ..	..	..	4·5	5 4 0	
Total ..	178	..	210	..	

The above figures are for wearing surfaces only. The Municipality has laid three roads with concrete wearing surfaces which are now being covered by an asphaltic carpet.

For roads having mainly bullock cart traffic, sett pavement has answered well and where there is mixed traffic we generally provide 6 ft. to 8 ft. margins of sett pavement for carts and the remainder of the width is laid with an asphalt carpet for automobiles. Sheet asphalt has proved very satisfactory under all traffic conditions and asphaltic concrete and mixed macadam for medium traffic.

These methods, however, require a special plant and specially trained staff and are hence suitable for large cities only, which have adopted a continuous programme from year to year. For country roads penetration macadam should be sufficient, as materials locally available can be conveniently used with the help of a small boiler and a few pouring cans.

In this connection the manufacture of cold products, *viz.*, asphalt emulsions has a great promise of simplifying the process of laying, as the stuff can be used straight from the barrel without any heating.

A good surface drainage system and a stable foundation are the essential points of a good road, and no surfacing however costly will be successful unless attention is paid to this.

The initial cost of these methods is considerably more than that of a water-bound road surface, but the advantages derived are :—

(1) Low annual maintenance.
(2) Longevity of the pavement.
(3) Ease of tractive effort.
(4) Elimination of the dust nuisance.
(5) Saving in collection of refuse and watering.
(6) Elimination of nuisance arising from frequent road repairs, etc.
(7) Sanitary.
(8) Surface easily scavenged and cleansed.
(9) Great saving in tyres to motorists.

In the case of roads requiring new foundations the entire cost can be properly met from borrowings, so that only interest, depreciation and maintenance can be charged to revenue, thus lowering appreciably the burden of the tax-payers.

Specifications for the various methods are detailed below.

I.—General directions for surfacing with macadam.

1. The thickness of the surface coating of tar macadam when consolidated by rolling should be from 2 to 3 inches according to traffic requirements. For a greater thickness than 3 inches the material should be applied in two coats.

2. The finished surface should have a cross fall of about 1 in 32.

3. The aggregate of the new surface of tar macadam should be composed of broken stone of approved quality, or selected slag of approved quality, and should contain at least 60 per cent broken to the size of $2\frac{1}{2}$ inches, not more than 30 per cent of from $2\frac{1}{2}$ inches to $1\frac{1}{4}$ inches, and 10 per cent of $\frac{3}{4}$ inch to $\frac{1}{2}$ inch for closing. The last mentioned size should be kept separate and used as top dressing during rolling operations.

4. The stone used must be thoroughly dried before being coated with tar.

5. The quantity of tar used to coat one ton of stone should be approximately from 9 to 12 gallons, varying according to the sizes of the stone, the grade of tar used, the method of mixing and other conditions.

6. The tar macadam, after having been spread and levelled, should be rolled into a smooth surface, but too much rolling should be avoided.

Less rolling is required than in the case of water-bound macadam.

A 10 ton roller is a suitable size for use in most cases, but good results can be obtained by using a 6 ton roller and finishing with a 10 ton roller.

7. Stone chippings, crushed gravel, coarse sand or other approved material (free from dust) not larger than will pass through a ¼ inch square mesh, should be used for gritting in quantity not exceeding 1 ton for 300 to 350 superficial yards if grit is used, and 1 ton for 200 to 250 superficial yards if coarse sand is used.

II.—Construction specification.

3″ asphalt macadam surface. Finished thickness 3″ or as required.

Spreading and compacting coarse aggregate.

(1) Prior to spreading coarse aggregate the prepared base shall be cleaned of all loose and foreign matter. The coarse aggregate which consists of 2½″ metal shall then be spread upon the base in a uniformly loose layer 4″ thick. Each load shall be spread outside of the area upon which it is dumped. Every precaution shall be taken to prevent the aggregate from becoming mixed or coated with dirt or other objectionable matter before and after spreading.

(2) The coarse aggregate shall then be dry rolled with a steam road roller weighing not less than 10 tons. The rolling shall start longitudinally at the sides and gutter and proceed towards the centre of the pavement, overlapping on successive trips by at least one-half of the width of the roller. The compacted coarse aggregate shall possess a fairly firm and even surface true to the grades and cross sections shown on the plans and present a texture which will allow of uniform penetration of the asphalt. If any irregularities appear during or after rolling they shall be remedied by loosening the surface and removing or adding coarse aggregate as may be required, after which the area disturbed including the surrounding surface shall be rolled until satisfactorily compacted to a uniform surface. All coarse aggregate which becomes coated or mixed with dirt, dust or foreign substances prior to the application of asphalt shall be removed and replaced with clean aggregate of the same kind and compacted as specified.

First application of asphalt.

(1) Upon the rolled coarse aggregate, hot asphalt shall be uniformly applied at the rate of from one and a half (1·5) to one and three quarters (1·75) gallons per square yard as directed by the Engineer.

Asphalt shall be applied only when the coarse is thoroughly dry for its entire depth, and unless otherwise permitted by the Engineer.

Application of the asphalt shall be made by means of a pressure distributor or with hand pouring pots.

(2) The asphalt shall be heated in kettles to secure uniform heating of the entire contents and shall be brought to a temperature of 300° to 350° F. as directed by the Engineer. A thermometer must be provided to determine the temperature of the asphalt during heating and prior to application.

Hand pouring pots used for applying asphalt shall have a capacity of not less than 3 gallons and shall be equipped with slotted spouts so placed that when the can is emptied by carrying it forward with the end of the spout close to the road surface the width of application shall be not less than 8 inches. Each pot

shall be marked to gauge for accurately measuring the charge of asphalt before it is distributed. The distance to be covered by each charge shall be measured off and the pouring operation conducted so that the rate of application will be uniform as the pot is emptied. The direction of successive pourings shall be reversed. Application shall be made at such angle to the centre line of the road or longitudinally as directed by the Engineer. During pouring the spout of the pot shall be kept within 6 inches of the surface of the road. In distributing slots shall be kept free from obstructions and shall be cleaned as necessary to insure a uniform distributing aperture. A narrow spout pouring pot may be used to apply asphalt necessary to touch up all spots unavoidably missed during the original application.

Filling surface voids with intermediate aggregate.

After the first application of asphalt, and if practicable while still warm, a thin layer of dry intermediate aggregate consisting of $\frac{3}{4}''$ to $1''$ metal shall be broadcasted over the treated surface in such quantity as to fill the surface voids and just cover the treatment. It shall then be broomed if necessary, to break up all clumps and produce a uniform covering, after which the pavement shall be steam rolled until thoroughly compacted and interlocked.

Suitable precautions shall be taken to prevent the distribution of intermediate aggregate over any portion of the coarse aggregate which has not received the first application of asphalt and in no case shall it be dumped directly upon either the treated or untreated coarse aggregate.

Seal coat.

After the intermediate aggregate has been thoroughly rolled stiff the pavement shall be swept clean of all loose material and treated with a second application of heated asphalt under the same conditions and in the same manner as previously specified, except that the rate of application shall be from one half (0·5) to three quarters (0·75) gallon per square yard as directed by the Engineer.

If hand pouring pots are used, the lines of distribution shall cross those of the first applications at an angle of approximately 90 degrees. After the second application of asphalt and if practicable while it is still warm, dry fine aggregate consisting of $\frac{1}{4}''$ grit shall be broadcasted over the surface and rolled until thoroughly bonded to the road. As required additional fine aggregate shall be spread and broomed over the surface during rolling in sufficient quantity to take up all excess of asphalt.

Upon completion of the pavement, however, only a very light uniform covering of loose aggregate shall be allowed to remain on the road. The finished surface shall be uniform, free from ruts or irregularities in contour and true to the required grade.

Protection of pavement.

During the period between the initial compaction of the coarse aggregate and completion of the seal coat the surface course shall be protected from all traffic other than that absolutely essential to its construction.

III.—Specification for mixed macadam with a mixed seal coat.

The mineral aggregate shall consist of trap rock, other sound stone, or slag, satisfactory to the Engineer consisting of pieces as nearly cubical as possible, not larger than $1\frac{1}{4}''$ in their largest diameter and not smaller than $\frac{1}{2}''$ and from 10% to 15% of clean, sharp sand by weight as determined by the Engineer.

The mineral aggregate shall be mixed in the same manner as specified for sheet asphalt and asphaltic concrete and the proportion of asphaltic cement shall be such that the mixture shall not show excess or deficiency of bitumen.

The mixture shall be hauled to the road and laid and rolled in the same way as specified for asphaltic concrete to a finished thickness of not less than $2\frac{1}{2}''$.

Mixed seal coat shall consist of fine graded sand of the same quality as specified for sheet asphalt and a quantity of asphaltic cement just sufficient to cover all particles.

The mixture shall be laid as in the case of sheet asphalt but to a thickness of $\frac{1}{2}''$ only. It shall then be rolled and swept over with Portland cement or stone dust.

IV.—Specification for 2″ asphaltic concrete.

Asphaltic concrete shall be laid in one layer of 2″ thickness.

The mineral aggregate shall consist of crushed trap rock, other sound stone or slag (free from weathered and dirty particles), sand and a finely powdered mineral filler, all of which shall meet the approval of the Engineer.

The sand and filler shall be of the same quality as specified for sheet asphalt.

The stone shall all pass a screen of 2 meshes to the lineal inch and all retained on a 10 mesh screen.

The aggregate and asphaltic cement shall be mixed in the same way as specified for sheet asphalt and the proportions shall be such that the combination shall consist of a standard sheet asphalt surface mixture and an amount of broken stone containing not more than from 8 to 22% of particles passing a 4 mesh and less than 10% of particles passing a 2 mesh screen, showing no excess or deficiency of bitumen.

The mixture shall then be hauled to the street in lorries covered with canvas and shall be laid at a temperature of not under 280°F., by means of rakes to the correct depth and then rolled by Tandem rollers, Portland cement or stone dust being swept over it after it has consolidated.

Statistical information relating to the Bombay Municipality.

Statements and information supplied to the Government of Bombay by the Bombay Municipality showing the financial effects of substitution of asphalt for water-bound road surfaces, and the initial and maintenance costs of various methods of asphalting. Reproduced by the courtesy of the Chief Engineer and Joint Secretary to the Government of Bombay, Public Works Department.

A.—*Information supplied by the Municipal Commissioner, Bombay, in June 1928 in reply to certain questions regarding roads.*

Information asked for.	Replies.
1. Total number of miles (and square yards) of original water-bound macadam surface under the Bombay Municipality.	143 miles out of a total of 178 miles in 1921-22 ; area approximately 33,55,000 sq. yards.
2. Total cost of construction of 1 above and per sq. yd.	Cannot be given. Present cost about Rs. 1-8-0 per sq. yd. for 6″ metalling.
3. Life of water-bound macadam surface road.	Varies from 6 months to 2 years according to traffic conditions.
4. Total cost of maintenance of water-bound macadam surface (and per sq. yd.) of 1 above.	Rs. 1-2-0 per sq. yd. for 3″ resurfacing.
5. Total cost of annual maintenance of water-bound macadam surface (and per sq. yd.) of such portion as was subsequently asphalted, as per 6 below.	Nil so far.
6. Number of miles asphalted out of 1.	11 miles out of a total of 20 miles.
7. Total cost of construction of asphalted roads (and per sq. yd.) of 6.	Rs. 30,51,185 for 20 miles for wearing surface only.

B.—*Initial cost and estimated maintenance costs of various methods of asphalting.*

Method.	Life.	Initial cost per sq. yard.	Estimated maintenance cost p. a. per square yard.
	Years.	Rs. A. P.	Annas.
2″ asphaltic concrete	12	4 8 0	5
2½″ mixed macadam with ½″ mixed seal coat.	12	4 0 0	6
3″ penetration macadam	10	3 0 0	7

C.—*Note showing the method followed in fixing the annual cost of repairs and renewals given in statement.*

3″ sheet asphalt on 4″ cement concrete laid over existing rubble packing.

Unit area 10,000 sq. yards		(A).
Cost of new surface Rs. 6·5 per sq. yard		(B).
Life of surface 15 years		(C).
Number of renewals in 30 years	1	(N).
Cost of renewal in 30 years	10,000 (A) × 6·5 (B) × 1 (N).	
	=Rs. 65,000.	
Cost of renewal per annum	$\frac{65,000}{30}$ =2,167 (D).	
Cost of annual repairs at 2 annas per sq. yard		Rs. 1,250 (E).
Annual charges for maintenance and renewal		2,167 (D)+1,250 (E).
		Rs. 3,417.
Interest at 6% on Rs. 1,12,500		Rs. 6,750.
Sinking Fund at 4% for 30 years on Rs. 1,12,500		Rs. 2,006.
Total yearly charges		Rs. 12,173.

Same as above but with 8 ft. margins on either side of the road to be sett paved.

Unit area 10,000 sq. yards		(A).
Cost of new surface (inclusive of setts) Rs. 6·25 per sq. yard		(B).
Life of surface 15 years		(C).
Number of renewals in 30 years	1	(N).
Cost of renewal in 30 years	10,000 (A) × 6·25 (B) × 1 (N).	
	=Rs. 62,500.	
Cost of renewal per annum	$\frac{62,500}{30}$ =Rs. 2,083 (D).	
Cost of annual repairs at 2 annas sq. yard		Rs. 1,250 (E).
Annual charges for maintenance and renewal		Rs. 2,083 (D)+1,250 (E).
		Rs. 3,333.
Interest at 6% on Rs. 1,10,000		Rs. 6,600.
Sinking Fund at 4% for 30 years on Rs. 1,10,000.		Rs. 1,962.
Total yearly charges		Rs. 11,895.

D.—*Statement showing the financial effects of the substitution of asphalt roads for water-bound surfaces.*

Number.	Mode of construction.	Unit area in square yards.	Cost per sq. yd.			Capital expenditure per unit area.	Estimated life.		Details of maintenance per unit area.			Annual charges for maintenance and renewal.	Total annual charges for maintenance per unit area.	Cost of water-bound surfacing at Rs. 1·2 per sq. yd.	No. of renewals if water-bound surfacing used.	Total revenue charge p. a. per unit.	Saving p. a. per unit area under revised procedure (col. 17 *minus* col. 14).	Percentage saving on the cost of water-bound surfacing.
									Loan charges.									
			Foundation.	Surface.	Total.		Foundation.	Surface.	Interest at 6%.	Sinking Fund 4%.	Total.							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
			Rs.	Rs.	Rs.	Rs.	Yrs.	Yrs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	No.	Rs.	Rs.	Rs.
1	3″ sheet asphalt on 4″ cement concrete	10,000	4·75	6·50	11·25	1,12,500	30	15	6,750	2,006	8,756	3,417	12,173	12,000	1½	18,000	5,827	32·4%
2	Same as above but width 8′ margins on either side sett paved.	10,000	4·75	6·25	11·00	1,10,000	30	15	6,600	1,962	8,562	3,333	11,895	12,000	1½	18,000	6,105	33·9%

NOTE.—The information given is in respect of 3″ sheet asphalt on concrete foundations, which has been largely adopted for important roads in Bombay. It should be clearly understood that the figures are for roads subjected to heavy traffic only.

BENGAL.

Little work with improved road surfaces has been done outside the city of Calcutta. The information below has kindly been furnished by the Chief Engineers to the Corporation of Calcutta, the Calcutta Port Commissioners, and the Calcutta Improvement Trust.

CALCUTTA CORPORATION.*

Prior to 1917, Calcutta Corporation made a number of experiments and put down a considerable area of road surface using 'Tar Macadam' laid mainly by the 'Penetration' or pouring method. These road surfaces were a great improvement but still left a great deal to be desired and with the adoption of 'bitumen' as a binder, the use of tar or pitch has been definitely abandoned with satisfactory results.

The system adopted is that generally known as the hot mix asphaltic concrete method, the thickness of the carpet being determined by traffic and other local conditions. Surface painting is also adopted to a considerable extent in the suburban and outlying areas, the bitumen being applied hot.

The following mileages of roads have been paved with asphaltum in Calcutta up to the end of 1927.

3″ thick	1·00
2″ thick	37·58
1″ thick	8·50
½″ thick	7·25

There are three asphalt mixing plants situated at a central depot at Palmer's Bridge pumping station, each plant having an output of about 10 tons per hour.

The stone metal used is prismodial Trap which is machine crushed and screened to gauge at the depot. The materials are heated and screened and mixed in the plant in definite weighed proportions according to the maximum density curve for the particular thickness of road carpet to be laid. The maximum density curve is checked up from time to time.

Bitumen.—The bulk of the bitumen used is a residual bitumen from a petroleum base and is a standardised product manufactured by the large oil concerns such as the Standard Oil Company and the Asiatic Petroleum Company. A penetration of about 30/40 is adopted for the asphaltic concrete carpets while a higher penetration of 100 or over is found more suitable for surface painting. Local materials available and local conditions of climate, traffic, etc., control and indicate the most suitable penetration to adopt.

Recording thermometers are used to keep a check on the heating of the materials.

Transport, etc.—The hot mixture is transported to the road to be surfaced in motor lorries fitted with steel tipping bodies.

The ordinary standardised rolling methods are adopted, cross rolling and diagonal rolling being done wherever possible which unfortunately is not very frequent except in the case of wide roads.

*Note by Mr. J. R. Coats, B.Sc., M. Inst. C.E., M. I. Mech. E., Chief Engineer to the Corporation of Calcutta.

The asphaltum paving is ordinarily laid on the old water-bound macadam road surface which is prepared by cutting and dressing, if required, to receive it.

A concrete foundation has also been used occasionally in the case of newly constructed roads or in cases where the old macadam crust was not thick enough. On the whole good results have been obtained although there have been occasional failures which have been traced to definite causes and noted for future guidance. The main causes have been insufficient thickness of paving to withstand heavy bullock cart traffic and weak foundations.

Experiments have also been carried out with the use of cold emulsions of bitumen and it would appear that there is likely to be a wide field for the use of this class of material but sufficient time has not yet elapsed to give an authoritative opinion.

The working systems adopted in Calcutta Corporation are the evolution of some 12 years' experience of laying bituminous roads in that city and have been carefully organised and modified whenever necessary to give maximum economy combined with efficiency and convenience to traffic.

Analyses of rates for asphaltum work are given in the following statement.

CORPORATION OF CALCUTTA.

Analyses of rates for Asphaltum work for 1926-27.

Analyses of rates for Asphaltum

Particulars.	Asphaltic concrete pavements											
	3″ Layer.						2″ Layer.					
	Quantity.	Rate.			Amount.			Quantity.	Rate.			
		Rs.	A.	P.	Rs.	A.	P.		Rs.	A.	P.	
1. Stone chip No. 1 ..	1,200 c. ft.	33	0	0	742	8	0	800 c. ft.	33	0	0	
2. Stone chip No. 2 ..	1,050 ,,							700 ,,				
3. Sand	2,160 ,,	11	6	3	246	0	7	1,440 ,,	11	6	3	
4. Asphaltum	260 cwt.	6	3	0	1,608	12	0	173 cwt.	6	3	0	
5. Katni cement	6 tons.	50	0	0	300	0	0	4 tons.	50	0	0	
6. Steam coal	6 ,,	8	12	0	52	8	0	4 ,,	8	12	0	
For 1,000 sq. yards ..	..		..		2,949	12	7	..		..		
1. Cost of material per sq. yard.	..		..		2	15	3	..		..		
2. Preparation of bed ..	..		..		0	6	0	..		..		
3. Lorry charges	..		..		0	5	0	..		..		
4. Cost of asphalt mixture, preparation, laying and consolidating with roller complete.	..		..		0	4	3	..		..		
5. Tools and plant ..	..		..		0	3	0	..		..		
					4	1	6	..		..		
					Say 4	0	0	..		..		

Particulars.	Asphaltic mastic water-proofing.					
	⅜″ layer on single storey roofs.					
	Quantity.	Rate.			Amount.		
		Rs.	A.	P.	Rs.	A.	P.
1. Stone chip No. 1	*Nil.*	..			..		
2. Stone chip No. 2.	*Nil.*	..			..		
3. Sand	1,000 c ft.	11	6	3	113	14	6
4. Asphaltum	75·71 cwt.	6	3	0	468	7	4
5. Katni cement	2·42 tons.	50	0	0	121	0	0
6. Steam coal	2·33 ,,	8	12	0	20	6	3
For 1,000 sq. yards ..	..	..			723	12	1
1. Cost of material per sq. yard	..	..			0	11	7
2. Preparation of bed	..	..			0	2	0
3. Lorry charges	..	..			0	1	6
4. Cost of asphaltum mixture, preparation, laying and consolidating with roller complete.	..	..			0	4	6
5. Tools and plant	..	..			0	0	6
					1	4	1
					say 1	4	0

CALCUTTA.

work for 1926-27.

for road surfaces.

	1" Layer.			½" Layer.		
Amount.	Quantity.	Rate.	Amount.	Quantity.	Rate.	Amount.
Rs. A. P.		Rs. A. P.	Rs. A. P.		Rs. A P.	Rs. A. P.
} 495 0 0	*Nil.*	..	..	*Nil.*	..	..
164 0 5	667 c.ft.	33 0 0	220 1 9	333 c.ft.	33 0 0	109 14 3
1,070 7 0	917 ,,	11 6 3	104 7 3	583 cwt.	11 6 3	66 6 5
200 0 0	111-6-0 cwt.	6 3 0	690 8 5	70·07 ,,	6 3 0	433 8 11
35 0 0	2·60 tons	50 0 0	130 0 0	1·30 tons	50 0 0	65 0 0
	3 ,,	8 12 0	26 4 0	2·23 ,,	8 12 0	19 8 3
1,964 7 5	..	..	1,171 5 5	..	..	694 5 10
1 15 6	..	..	1 2 9	..	..	0 11 1
0 4 0	..	..	0 2 0	..	..	0 2 0
0 4 0	..	..	0 2 0	..	..	0 1 6
0 3 0	..	..	0 2 0	..	..	0 1 0
0 2 0	..	..	0 1 0	..	..	0 0 6
2 12 6	..	..	1 9 9	..	..	1 1 0
say 2 12 0	.	..	say 1 12 0	..	..	say 1 0 0

Surface treatment with asphaltum.

Painting stone or brick roads.			Seal coating on asphalt pavement roads.		
Quantity.	Rate.	Amount.	Qunatity.	Rate.	Amount.
	Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.
Nil.	..	..	*Nil.*	..	..
100 c. ft.	33 0 0	33 0 0	*Nil.*	..	..
100 c. ft.	11 6 3	11 6 3	100 c.ft.	11 6 3	11 6 3
52 cwt.	6 3 0	321 12 0	15 cwt.	6 3 0	92 13 0
..	..	..	..	..	..
½ ton.	8 12 0	4 6 0	½ ton.	8 12 0	4 6 0
		370 8 3	..	..	108 9 3
..	..	0 5 11	..	..	0 1 9
..	..	0 2 0	..	..	0 2 0
..	..	0 0 3	..	..	0 0 3
..	..	0 0 6	..	..	0 0 6
..	..	0 0 3	..	..	0 0 3
		0 8 11	..	..	0 4 9
..	..	say 0 10 0	..	..	say 0 5 0

CALCUTTA IMPROVEMENT TRUST.*

(1) *2" asphaltic concrete on lime concrete foundation.*—This form of construction has proved unsatisfactory, as the lime concrete is too friable to resist the 'creeping' tendency of the asphalt carpet. No roads have been constructed in this way since 1922.

(2) *2" asphaltic concrete on water-bound stone macadam foundation.*—This form of construction is largely used by the Calcutta Corporation and has proved generally satisfactory, provided the foundation is sufficiently consolidated and the asphalt is properly mixed and not overheated. It costs about Rs. 45 per 100 sq. ft. for foundation (thickness 13" including brick soling) and Rs. 40 per 100 sq. ft. for surfacing.

(3) *2" asphaltic concrete on cement concrete foundation.*—Some experimental lengths have given good results. The cost is about Rs. 44 per 100 sq. ft. for foundation (6" thick, 1 : 2 : 4) and Rs. 40 per 100 sq. ft. for surfacing.

(4) *2" asphalt blocks on cement concrete foundation.*—It is proposed to experiment with this method of surfacing in a roadway over a reinforced concrete bridge carrying heavy traffic.

(5) *Water-bound stone macadam foundation with asphalt grouted surface.*—This method of construction is being largely adopted by the Trust for newly made roads with moderately heavy traffic, and for resurfacing existing roads. The grouted layer is from 2" to 2½" thick, and is laid on a cushion of dry sand, which is forced up into the interstices between the stones, thus reducing the quantity of grout required. The cost (total thickness 15" including brick soling and grouted layer) is about Rs. 45 per 100 sq. ft. for foundation (thickness 13" including brick soling) and Rs. 21 per 100 sq. ft. for surface layer.

(6) *Water-bound stone macadam foundation with cement grouted surface.*—Experiments have been made with this system with hopeful results. It appears that the best method of applying the grout is to sandwich it in the form of a stiff paste between two layers of stone so that the roller forces it both up and down. No figures of cost are yet available.

(7) *Water-bound stone macadam with asphalt painted surface.*—This is the usual form of construction for roads carrying medium traffic. The asphalt is applied by hand about 2 months after the road has been opened to traffic, and is kept heavily sanded for several weeks. The cost (surfacing only) is about Rs. 7 per 100 sq. ft.

(8) *Concrete.*—All concrete roads have been laid experimentally by the Improvement Trust and are giving good results. Experience to date shows that contraction joints should be provided at intervals of about 30 ft. and that a good wearing road is obtainable with the following specification :—

Thickness.—Bottom course .. .. 5"

Top course .. .. 2"

Coarse aggregate.—

Bottom course, broken trap rock graded from 1½" to ¼".

Top course, broken trap rock graded from ¾" to ¼".

*Note by Mr. M. R. Atkins, B.Sc., M. Inst. C. E., Chief Engineer.

Fine aggregate.—Crushed quartz gravel graded from $\frac{1}{4}$" downwards.

Cement.—Indian manufacture, developing a tensile strength of 700 lbs. per sq. inch at 7 days.

Concrete proportions.—Bottom course .. .. 1 : 2 : 4

Top course .. .. 1 : 1 : 2

Foundation.—Layer of broken brick, punned and rolled.

Method of curing.—Ponding with water for 14 days.

Surface treatment on completion.—Silicate of soda, 3 applications at intervals of 24 hours.

Reinforcement does not appear to be essential except when the ground is liable to uneven settlement.

The cost of a concrete road is about Rs. 75 per 100 sq. ft.

CALCUTTA PORT COMMISSIONERS.*

In the Kidderpore Dock area there are three types of roads, namely (1) water-bound macadam, (2) jhama brick khoa and (3) stone sett roads. Without regard to width of road, drainage of subsoil water, traffic conditions, etc., the sections of these roads are generally as follows :—

1. *Water-bound macadam road.*—3" picked jhama brick soling, 6" consolidated, 2" size, hard black trap stone road metal.
2. *Jhama brick khoa road.*—3" picked jhama brick soling, 6" consolidated jhama metal khoa of $2\frac{1}{2}$" size.
3. *Stone sett road.*—Stone and cement concrete 7" thick, mixture 5 : 3 : 1, aggregate 2" black trap stone. 3" brick soling was laid where soil of formation demanded it. Stone setts 10" × 5" × $4\frac{1}{2}$" size were laid, embedded in $\frac{1}{2}$" of silver sand, diagonally from the centre line of the road, the line of the setts on one half of the road being at right angles to the line of the setts on the other half of the road.

In most cases in the area no provision has been made for subsoil drainage nor has it been possible to do so. Surface run off has been allowed for in some cases by means of stone slab channels with channel gratings connected to a pipe drain in the centre of the road, and in others by open drains on both or one side of the road.

The methods of construction, maintenance and surface treatment of these roads have been as follows :—

1. *Construction.*—(*a*) Water-bound macadam.

The ground is excavated to the full width of the road to a depth 9" below the proposed level of the finished road, the formation being dressed to the proposed camber of the road surface, a fall of 1 in 40 usually being allowed. The formation is then brick soled 3" brick on flat with jhama bricks. Stone road metal of 2" size is screened and spread to a thickness of $4\frac{1}{2}$" and rolled with a 10 ton steam road roller 3 times dry. The metal usually obtained is black trap and 2" metal is found to be a suitable size for the kind of stone and type of road. The pieces of stone should be as nearly cubical as practicable and regular in size

* Note by Mr. J. McGlashan, M. Inst. C. E., Chief Engineer.

to minimise crushing by the roller, irregular size metal is liable to crush more. With a softer stone it would probably be advisable to use $2\frac{1}{4}$" to $2\frac{1}{2}$" sizes. After rolling 3 times dry the metal is watered sufficiently to assist in consolidation and to minimise crushing, care being taken to ensure that too much water is not used to avoid softening and weakening the formation earth. Rolling is carried on whilst watering is being done and consolidation is considered to be sufficient when the roller has passed over the metal about 80 times. Complete consolidation is not effected in this layer, to permit a better bond between the two layers. The second layer of 2" stone metal $4\frac{1}{2}$" thick is then spread and rolled 2 or 3 times dry. Further consolidation is carried out with watering judiciously as in the consolidation of the first layer. Binding material is then spread. As well consolidated metal contains about 25% to 30% of voids, the quantity of binding used is based on this, a little excess material being used to ensure that all interstices are filled but care however being taken to avoid displacement of the metal through a large excess of binding material. The binding material used is composed of stone chips and stone dust obtained from screening the metal, and when this is not obtained in sufficient quantities building rubbish consisting of old mortar, plaster, small pieces of brick, etc., from dismantled buildings is added. This mixture makes a good binder being neither too earthy nor too sharp. In the event of building rubbish not being available a binding mortar consisting of one part soorki, two parts cinders and one part rejected lime mixed in the mortar mill has been used.

After the spreading of the binder, watering is done followed at once by rolling, the wet binding material being well brushed over the surface as the roller passes backwards and forwards till consolidation is complete. In rolling the second laver of metal the roller is passed over from 90 to 100 times.

(*b*) *Jhama brick khoa road.*—Excavation, dressing formation to the camber and soling is done as for a macadam road. 9" of jhama metal khoa of $2\frac{1}{2}$" size is spread, rolled 2 or 3 times dry with a 6 ton roller and finally consolidated with careful watering, the screenings from the khoa metal alone or mixed with building rubbish being used as binding material. It is not advisable to use a roller heavier than 6 ton or excessive attrition will take place.

(*c*) *Stone sett road.*—The approach road to riverside berths from the Neemak Mahal Garden Reach Road junction was constructed in the following manner :—

The formation width of 20′ was excavated to a depth of 12" below the proposed level of the finished road surface and dressed to a camber of 1 in 60. Where the formation earth was particularly bad 3" brick soling was laid, allowance being made for this in the excavation at the sites. Cement concrete in the proportion of 5 : 3 : 1, the aggregate being 2" stone metal, was laid to a thickness of 7" over the formation level and finished to the camber of the road being allowed to set under water. Stone setts of black trap rock 10" × 5" × $4\frac{1}{2}$" were laid bedded in $\frac{1}{2}$" of silver sand and grouted in with cement and sand grout. The setts were laid at an angle of 45° from the centre line of the road in opposite directions. The usual precautions of watering the sett paving, keeping the road closed to traffic till the cement grout had set properly, were observed.

2. *Maintenance of roads.*—Our practice is to repair pot holes as they develop, and to periodically re-coat the road with a thick layer of stone. This

ensures that a proper thickness of metal is maintained and is preferable to patching and repairing as required, under which method it is likely that, although a good surface is maintained, the thickness of the metal may become inadequate.

In re-coating the road surface there is the choice of (1) scarifying and (2) picking up the road. In the case of water-bound macadam roads it has been our practice to pick up to a depth of about $1\frac{1}{2}$". The old metal is screened and then mixed with additional new metal of 2" size and the mixture spread to such a depth as will give 6" consolidated metal finally. Usually a layer of 3" is sufficient. Consolidation dry, wet and with binding is then carried out in the same manner as in constructing a new road. The screenings from the old and new metal are used as a binder with as much additional building rubbish as is necessary.

Similarly, in repairing a khoa road the surface is picked to a depth of about 2", the old khoa screened, mixed with the required quantity of new $2\frac{1}{2}$" khoa and consolidated and bound with binding material composed of the screenings of the old and new khoa.

3. *Surface treatment.*—The rapid development of high speed mechanical traction has enormously increased the wear and tear on our roads. Motor lorry and motor omnibus traffic has been particularly damaging to road surfaces, producing in a short time surface corrugations and pot holes of considerable depth. The impact upon the road surface combined with the uneven distribution of weight in the case of these vehicles increases the amount of damage done.

In the Kidderpore Dock area we have the problem of certain roads subjected to extremely heavy traffic and others which do not have sufficient traffic to keep them properly rolled under existing climatic conditions. The roads subjected to very heavy traffic, notably the swing bridge approaches on Garden Reach Road and Circular Garden Reach Road, rapidly develop pot holes, and require continual attention in making good these weak spots, and have to be resurfaced every year. Other roads such as roads East and West of No. 1 Dock and Kantapuker Road generally have a disintegrated surface due to insufficient watering in the dry weather, insufficient traffic and washing out of binding material during the monsoon.

With the primary objects of preventing surface disintegration and the lessening of the dust nuisance a programme of surface dressing with various proprietory materials was embarked upon about 15 months ago. The experiments carried out were as follows :—

Six different materials have been used :

(1) Mexphalte.

(2) Bitarco.

(3) Mexaco road oils.

(4) Ormul.

(5) Colfix.

(6) Colas.

There are two methods of application of each material, *i.e.*, grouting and surface dressing. In only two cases has grouting been done, with Mexphalte and with Colas.

Mexphalte and Bitarco have to be heated to a certain temperature and reduced to a liquid state before application. Mexaco road oil is applied cold and is a preparation of bitumen and oils treated under heat. Ormul, Colfix and Colas are emulsions and are applied cold.

Mexphalte and Bitarco applied as a surface dressing have little penetration and result in a skin of material over the macadam. The other four materials applied cold penetrate to a greater extent but do not give an even skin over the surface. In the case of Mexaco road oil it has been found that under traffic conditions the binding materials appear to work to the surface and eventually give a surface coating.

The method of preparation of the road surface for the receiving of the dressing is the same in all cases with the exception that in the case of the emulsions it is not essential that the road surface be perfectly dry, in fact it is in some cases recommended that prior to application of the material the road surface be watered.

Assuming the road to be in a good condition all dust and dirt are removed by brushing, wire brushes being used where necessary. It is essential that cleaning be done thoroughly. Mexphalte and Bitarco are poured in a hot liquid state on to the dry prepared road surface and either brushed or squeezed over to an even thickness depending upon the condition of the surface. Small stone chippings, pea gravel or sand is then lightly spread immediately and rolled in with a light roller. When this has been done the road can be opened to traffic. Mexaco road oil is poured on the surface and brushed to as even a layer as possible, the quantity used depending on the smoothness of the surface. It is left to stand from 48 to 72 hours to enable penetration to take place. Stone chippings or sand is then spread evenly and lightly over the oil and allowed to stand again for about 48 hours. Light rolling may then be done and the road opened to traffic.

Ormul, Colfix and Colas are poured over the prepared surface brushed in a manner similar to that described above, after which stone chippings or sand is immediately spread lightly and rolled in, after which the road can be opened to traffic.

The use of Colfix, Colas and Bitarco is so recent that we are not in a position to give an experienced and considered opinion on the results of using them. Both Mexphalte and Mexaco road oils have been found satisfactory in reducing dust, preventing the disintegration of the road surface during dry weather and during heavy rains, keeping the binding material together and, particularly in the case of Mexphalte, in reducing the development of pot holes and the wear on the macadam.

The rates per hundred sq. ft. for constructing a macadamised road with (*a*) 9″ jhama metal and (*b*) 9″ stone metal are as follows :—

	Rs.	A.	P.
(*a*) Cutting earth 100 c. ft. at Rs. 6-4-0 per 1,000 ..	0	10	0
Jhama soling 100 sq. ft. at Rs. 6 per 100	6	0	0
Jhama metal 75 c. ft. at Rs. 18 per 100	13	8	0
Consolidating 100 sq. ft. at Rs. 2-8-0 per 100 ..	2	8	0
	22	10	0

Say Rs. 24 per 100 sq. ft. including charges for steam road roller.

	Rs.	A.	P.
(*b*) Cutting earth 100 c. ft. at Rs. 6/4 per 1,000 ..	0	10	0
Jhama soling 100 sq. ft. at Rs. 6 per 100	6	0	0
Stone metal 75 c. ft. at Rs. 25-8-0 per 100	19	2	0
Consolidating 100 sq. ft. at Rs. 2-8-0 per 100 ..	2	8	0
	28	4	0

Say Rs. 30 per 100 sq. ft. including charges for steam road roller.

UNITED PROVINCES.*

During the last 3 years improved forms of road surfacing have been carried out on 74¼ miles as follows :—

	Miles.
1. Cement concrete	1¾
2. Asphalt Macadam T. R. A.	8¾
3. Asphaltic Concrete (Mexphalte)	1¾
4. Asphaltic Concrete T. R. A.	¼
5. Grouting T. R. A.	8¼
6. Grouting Mexphalte	8⅞
7. Grouting Pitch and Tar	⅛
8. Surface Painting T. R. A.	7½
9. Surface Painting Spramex	24⅝
10. Surface Painting Asphaltum	½
11. Surface Painting Tar	4⅞
12. Mexaco treatment	7
Total ..	74¼

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* Note on improved forms of road surface in the United Provinces by the Chief Engineer, Public Works Department, Buildings and Roads Branch, United Provinces.

The following is a very brief description of the work done, cost of the same and conclusions so far arrived at :—

1. *Cement concrete.*—This work consists of a 6″ slab, 20′ wide of cement concrete thickened at the edges to 9″ laid on the alternate bay system. The concrete has been laid in two layers and the mixture in each layer is 1 : 2 : 4, a stronger mixture was at first tried in the top layer but the results did not seem to justify the extra cost. The surface of the concrete was treated with silicate of soda. The cost has worked out at Rs. 5-12-0 per square yard. The concrete has been down for over two years and carries a very heavy load of bullock cart traffic, but up to the present there are no signs of wear on the surface.

In addition to the above work cement concrete has been laid round the corners of the hill road leading to Naini Tal and some of it has been down for 8 years, except for trouble at the joints the surface shows little signs of wear.

The conclusion I have arrived at is that this form of surface is eminently suited for heavy concentrated cart traffic.

2. *Premix.*—The asphalt macadam consists of a 2½″ coat, whilst the asphaltic concrete is only 2″ thick. The material is mixed and heated in a machine, carried hot to the site and laid. The cost of asphalt macadam with T. R. A. varies from Rs. 4-10-0 to Rs. 4-15-0 per square yard, whilst the cost of asphaltic concrete with Mexphalte is Rs. 4-11-0 and with T. R. A. is Rs. 5-1-0 per square yard.

Most of the work has been down for nearly 2 years and where the traffic is well distributed and moderate, it has been a success, but under concentrated bullock cart traffic there are distinct signs of waviness and even of breaking. The conclusion arrived at is that this form of surface is suitable for moderate and well distributed traffic, but will not stand up to very heavy concentrated bullock cart traffic, as during the hot weather it gets soft and the carts moving in one continuous line form ruts, sections cut through these ruts show that the movement is entirely in the surface coat and not in the foundation. A further disadvantage is that generally before the surface coat can be laid, an under coat of water-bound metal is required which brings the cost in excess of that of cement concrete.

3. *Grouting.*—Consists in laying a 3″ coat of stone and pouring bitumen heated to 350° in kettles at the rate of 1·75 gallons per square yard after consolidation of a seal coat of ·5 gallon per square yard is given.

The costs work out as follows :—

T. R. A. grout Rs. 3 to Rs. 3-12-0 per square yard.

Mexphalte grout Rs. 2-14-0 to Rs. 3-6-0 per square yard.

Pitch and Tar grout Rs. 3-4-0 per square yard.

The resulting surface under moderate traffic on a 16′ road has been a success but on a 24′ road under heavy traffic where carts are not diverted from one line, the surface ruts badly being too plastic in the hot weather. The rutting is more noticeable in T. R. A. than in Mexphalte and the latter gives a harder surface. From the excessive bleeding of T. R. A., I am inclined to think that the amount of bitumen poured is excessive and I am trying to overcome this by reducing the quantities of grout and seal to 1·5 and ·3 gallons per square yard.

The short length of pitch and tar has not proved a great success as it is breaking up, but a length laid in the Cawnpore municipality seems to be standing better.

In conclusion I consider that grouting is suitable up to 16′ width for moderate traffic, but should be avoided in greater widths where heavy bullock cart traffic is likely to be met with.

4. *Painting.*—Consists in pouring hot bitumen or tar over the consolidated water-bound surface at a rate of ·5 gallon per square yard. The cost for one coat of bitumen or two coats of tar is about 0-8-0 annas per square yard.

Tar painting on a kankar surface is excellent for light traffic and has been tried with success in Lucknow on the Mall; it gives a dustless surface and prolongs the life of the metal surface below.

T. R. A. has been tried on kankar and stone, it is equally successful under light traffic, but under bullock cart traffic it is apt to peel off owing to the grinding of the cart wheels forming a layer of dust between the paint and the water-bound coat.

Spramex paint has been used extensively on stone and after 9 months is holding well, though there have been cases where it has peeled off the same as T. R. A. Asphaltum tried on stone under light traffic has been down for 3 years with only one repaint after 2 years. The conclusions so far arrived at are that Road Board Tar No. 1 is undoubtedly the best for a kankar road; and that bitumen paint prolongs the life of a stone mile provided the traffic is not excessive, and if it can be prevented from peeling off will, in the course of time, with renewals, form a wearing surface over the water-bound metal.

5. *Mexaco.*—Prepared by Road Oil Company Limited, Calcutta, is a combination of bitumen and oil containing 65% bitumen. It is applied cold and the makers claim that it penetrates the surface and forms an efficient binder to water-bound surfaces. This material has the great advantage that it can be applied cold and does not require any expensive plant. The cost works out at 0-6-0 annas per square yard and one gallon covers 2½ to 3 square yards on the first application.

Several miles have been tried, but the first has only been done 7 months back and it is too early to say whether it will be a success, but it undoubtedly penetrates, binds the metal together and does not peel off like bitumen paint. Under light traffic it gives a good and dustless travelling surface, whilst under heavy traffic it seems to give better results than bitumen paint. In my opinion it is likely to prove a success specially on rough stone roads where the surface binding frequently works loose and blows away. Whether a second coat of Mexaco or bitumen will give the best results remains to be proved; experiments are being tried.

Experiments are being tried with Mexaco on kankar, but so far there does not appear to be much penetration and I am not prepared to say what the result will be like.

PUNJAB.*

The following table shows the progress made to date with improved forms of road surfaces on the arterial roads in this province :—

Nature of surface.	Mileage on 1st January 1927.	Mileage on 31st December 1927.
Stone metal, bitumen sprayed	9·755	9·965
Stone metal, tar sprayed	37·555	47·94
Stone metal, tar and bitumen sprayed	1·00	1·00
Stone metal, bitumen grouted, but left unsealed	2·97	37·645
Stone metal, bitumen grouted and sealed	4·875	16·88
Brick metal, bitumen grouted and sealed	*Nil*	23·125
Brick metal, bitumen grouted, but left unsealed	*Nil*	4·25
Whole brick, dipped in bitumen, laid as a pavement and surface sealed	*Nil*	0·25
Sand carpet	0·60	4·50
Total	56·755	145·555

I have also made enquiries regarding the work carried out by municipalities and although tar spraying and bitumen painting have been done in a number of places I do not think there is anything of special interest to report.

In 1923-25 a number of experiments were tried on the Grand Trunk Road near Lahore, but unfortunately I have not been able to trace any official report

* Letter from the Deputy Chief Engineer, Public Works Department, Buildings and Roads Branch, Punjab.

on the result of these experiments. The following statement, showing the results so far as they could recently be ascertained, may be of interest :—

Experiment lengths of road surfacings laid in miles 306 and 309 of the Grand Trunk Road in 1923—25.

Number of section.	Locality. Mile/ furlong.	Area.	Treatment.	Remarks. (January 1928).
		Sq. yds.		
1	305/1	694	Tar painting over Pathankot metal in February 1924 and repainted in August 1924.	The traffic over these experimental sections was reckoned as 315 tons per yard width per day. Mr. G. Gilbert, the officer in charge of the work, reports that with the exception of the bitumen penetration in furlong 308/2 all sections wore very badly and that by September 1926 the surfaces were so bad that they had to be coated with 1½-in. of sand carpet.* This carpet has since broken up in a number of places and has had to be repaired. It is now (January 1928) fairly hard, but wavy throughout, and in the hot weather it becomes soft and spreads on to the berms.
2	305/1	525	Tar and bitumen in equal proportions painting over Pathankot metal (August 1924).	
3	305/2	530	Bitumen painting over Pathankot metal in February 1924.	
4	305/2	611	Bitumen painting over a coat of crude oil on Pathankot metal (February 1924).	
5	305/3	400	Tar and bitumen in equal proportions painted over cement-grouted Pathankot metal (September 1924)	
6	305/3	394	Tar painting over cement-grouted Pathankot metal (September 1924).	
7	305/3	346	Jhama-brick ballast† grouted with mastic composed of equal parts by weight of sand and bitumen applied at the rate of 1·54 gallon mastic to the square yard (April 1924).	
8	305/4	144	Pathankot metal† grouted with the same mastic as above but applied at the rate of 1·47 gallons to the square yard (April 1924).	
9	305/4	109	Ditto—mastic applied at the rate of 1·77 gallons to the square yard (April 1924).	
10	305/4	388	Ditto—mastic applied at the rate of 1·39 gallons to the square yard (December 1924).	

* The sand carpet consisted of 49 parts by weight of Pathankot sand, 25 parts of ½" to ¼" stone chips, 16 parts of Portland cement and 10 parts of bitumen (E. Grade Mexphalte in sections 1—11 and 104 Grade Socony bitumen elsewhere).

† A 3-in. coat broken to 2-in. gauge.

Number of section.	Locality. Mile/furlong.	Area.	Treatment.	Remarks. (January 1928).
		Sq. yds.		
11	305 4—5	909	Glutrin and Pathankot metal (December 1923)	This was renewed in March 1926, with water-bound Serai-kala stone tar painted (2 coats) and again painted in May 1927. It is now (January 1928) in very good order.
12	305 5	1,311	Glutrin and limestone (January 1924).	
13	308 1	176	Serai-kala limestone, water-bound macadam (March 1924).	Resurfaced with water-bound Serai-kala stone metal and tar painted in March 1927.
14	308 1—2	293	Nalagarh stone, water-bound macadam (July 1925).	Including the sand carpet has broken up completely
15	308 2	165	Penetration 1·5 gallons of Socony bitumen per square yard of 1½ in. Pathankot quartzite metal broken to 1½ in gauge sealed with 0·5 gallon bitumen per square yard and gritted (March 1923).	The original surface is now very wavy.
16	308 2	165	Same as section No 15 but with a second sealing coat of 0·3 gallon bitumen per square yard (March 1923).	
17	308 2	43	Same as Section No. 15 ..	
18	308 2	267	6-in. plain cement concrete slab (1 : 2 : 4).	The sand carpet slides over the concrete and in places has spread 18-in. across the berm. The thickness is only ¼-in. in places, surface very uneven.
19	308 2	178	6-in. reinforced* concrete slab (1 : 2 : 4).	
20	308 2	178	6-in. plain cement concrete slab laid in two courses upper 1½-in. (1 : 2 : 2⅓) lower course (1 : 2 : 5).	
21	308 3	178	3-in. plain cement concrete slab (1 : 2 : 4).	
22	308 3	220	2-in. asphalt carpet consisting of 80 parts by weight of Pathankot sand, 10 parts of canal silt and 10 parts of E. Grade Socony bitumen (December 1923).	Surface hard but uneven. The thickness of the carpet varies from ¾" to 2". This also has spread on to the berms.
23	308 3	..	Water-bound macadam (April 1924).	Renewed February 1927.

* The reinforcement consisted of ½-in. diameter rods, 2 ft. 6-in. apart, 2-in. below the surface.

As a result of these experiments it was decided that bitumen-treated roads had a better chance of standing up to bullock cart traffic than concrete roads and consequently recent experiments have been restricted to using various grades of bitumen. The following give particulars of some of the specifications to which we have worked with analysis of cost. It is, however, too soon yet to draw any general deductions from the condition of the surfaces :—

Trinidad Asphalt (unsealed).

Position of work.	Date when laid.	Specification.	Analysis of cost per 100 sq. ft.	Rs.	a.	p.
Amritsar-Baijnath Road. Furlongs 3-5 of mile 44 (12 ft. wide).	April 1925	Penetration 1·25 gallons (15-3/8 lb) of Trinidad asphalt with 25% of flux oil per sq. yd. of 3-in. of Pathankot quartzite broken to 1½ in. gauge, no sealing coat.	25 c. ft. ballast at 25 per 100 c. ft.	6	4	0
			6¼ c. ft. bajri at 40 per 100 c. ft.	2	8	0
			139 lb asphalt at 14 per cwt.	17	6	0
			35 lb flux oil at 17 per cwt.	5	5	0
			Consolidation ..	1	0	0
			Labour and fuel in heating, mixing and applying.	1	1	0
		Actual cost per 100 sq. ft. ..		33	8	0
		Actual cost per sq. yd. ..		3	0	6

Socony Mastic (unsealed).

Position of work.	Date when laid.	Specification.	Analysis of cost per 100 sq. ft.	Rs.	a.	p.
Amritsar-Baijnath Road. Furlongs 6-8 of mile 44 (12 ft. wide).	April 1925	Penetration 1·75 gallons (27 lb.) mastic consisting of equal parts by weight of sand and Socony bitumen on each sq. yd. of 3-in. of Pathankot quartzite broken to 1½-in. gauge, no sealing coat.	25 c. ft. ballast at 25 per 100 c. ft.	6	4	0
			6¼ c. ft. bajri at 40 per 100 c. ft.	2	8	0
			1½ c. ft. sand at 15 per 100 c. ft.	0	4	0
			Consolidation ..	1	0	0
			150 lb. bitumen at Re. 1 per cwt.	15	0	0
			Labour and fuel in heating, mixing and applying.	1	1	0
		Actual cost per 100 sq. ft. ..		26	1	0
		Actual cost per sq. yd. ..		2	5	6

Mexphalte sealed with Spramex.

Position of work.	Date when laid.	Specification.	Analysis of cost per 100 sq. ft.	Rs.	A.	P.
Grand Trunk Road approaches to Ravi Bridge in miles 3 and 4 (28 ft. and 24 ft. wide).	December 1926 to January 1927.	Penetration 1·5 gallons (15¾ lb.) of Mexphalte with a sealing coat of 0·3 gallon (3¼ lb.) of Spramex per sq. yd. on 3-in. of Serai-kala stone broken to 2-in. gauge.	25 c. ft. ballast at Rs. 30 per 100 c. ft.	7	8	0
			8 c. ft. bajri at Rs. 30 per 100 c. ft.	2	6	0
			17 gall. (177 lb.) Mexphalte at Rs. 8 per cwt.	12	10	0
			3·3 gall. (35 lb.) Spramex at Rs. 8 per cwt.	2	7	0
			Consolidation ..	1	0	0
			Labour and fuel in heating, mixing and applying.	2	8	0
		Actual cost per 100 sq. ft. ..		28	7	0
		Actual cost per sq. yd. ..		2	9	0

Surface tarring has so far proved most satisfactory and the following analysis of the rates in Lahore may be useful .—

Item.	Rate.	First coat.		Second coat.	
		Quantity.	Cost.	Quantity.	Cost.
	Rs. A. P.		Rs. A. P.		Rs. A. P.
Tar	9 11 0 per cwt.	0·25 cwt.	2 7 0	0·08 cwt.	0 12 6
Grit	40 0 0 per 100 c. ft.	1 c. ft.	0 6 6	1 c. ft.	0 6 6
Sand	8 0 0 ditto	2 c. ft.	0 2 6	2 c. ft.	0 2 6
Fuel and labour in heating and rolling.	..	..	0 9 0	..	0 4 6
		First coat.		Succeeding coats.	
	Total cost per 100 sq. ft.	3 9 0		1 10 0	

BURMA.

Public Works Department.

The province of Burma has about 100 miles of roads with tarred and bituminous surfaces. There are many of these which have been laid 15 years ago and have stood up to exceedingly heavy traffic. They were made by applying a carpet of oil pitch on the water-bound surface soon after it had been consolidated; this pitch was a waste product in those days, but is now not being made by the oil companies as their existing processes do not produce the same pitch, but another which is not satisfactory.

Such roads which have been made of late have been treated with a mixture of Shalimar pitch and coal tar or Socony road pitch. The cost varies according to the penetration into the metalled surface, dependent on the quality of stone used and the period intervening between the construction of the road and the application of the grouted carpet.

The grouting costs from Rs. 10 to Rs. 16 per 100 sq. ft. which lasts for 2 or 3 years after which a yearly renewal coat costs about Rs. 3 per 100 sq. ft.

The results are found to be eminently satisfactory in that they prevent dust and keep the stones in position until they are worn away by traffic.

Particularly no other kinds of bituminous road construction have been undertaken in this province.

Rangoon Corporation.†

Prior to 1910 the roads of Rangoon consisted for the most part of varying widths of metalled surface on a very inadequate foundation composed mainly of laterite and in some cases broken brick. The application of tar, as a dust layer, had been tried, but the quality of the tar obtainable then was not suitable for road work, and the surfaces deteriorated very rapidly with the advent of the rainy season. It was about that time that the writer first considered the use of what is now known as residual bitumen, as a grouting or binding agent for macadam roads, and the Burma Oil Company through their Chief Chemist, Mr. Allen, was approached in order to determine if the residue from the refining stills, which at that time was considered as waste, could be utilised for road work.

Many trials were made with this material and eventually a "pitch" was obtained with which the writer experimented successfully on certain roads, so that it was decided to extend considerably the use of it.

Meanwhile in 1911 the Rangoon Municipality embarked on a programme of road reconstruction, with Val de Travers Asphalte on cement concrete foundations in the business quarters and stone sett paving for the heaviest trafficked roads in the vicinity of the docks and railway. Certain contracts were entered into and resulted in the laying of 2·34 miles of road 50 feet wide between kerbs with asphalte, and 1·14 miles of stone sett paving. The war

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* Note by the Chief Engineer, Public Works Department, Burma.

† Note by the Chief Engineer, Rangoon Corporation.

then put an effectual stop to further work of this nature, and in 1919 the roads of Rangoon could be classified as follows :—

Metalled Roads	79·04 miles.
Laterite Roads	3·43 ,,
Wood paved Roads..	0·31 ,,
Asphalt Roads	2·74 ,,
Kutcha Roads	11·42 ,,
Tarred Roads	3·23 ,,
Bitumen grouted	1·00 ,,
Granite setts	1·14 ,,
Total ..	102·31 ,,

Today, 1928, the classification is :—

Metalled Roads	30·14 miles.
Laterite Roads	7·79 ,,
Asphalte Roads	2·74 ,,
Kutcha Roads	4·66 ,,
Tarred Roads	61·95 ,,
Bitumen Roads	19·90 ,,
Granite setts	2·67 ,,
Concrete	0·17 ,,
Total ..	130·02 ,,

In 1920 the necessity for more or less wholesale reconstruction of the main roads was recognised, and the work of such reconstruction commenced. In Rangoon, particular attention has been directed to the strengthening of the foundations and improving the drainage of surface and subsoil water, and the form of construction which has been most generally adopted, with so far excellent results, has been the provision of new foundations consisting of stone trap, hand packed to a consolidated depth of from 10″ to 12″ surfaced with road metal consolidated to 4″ depth and grouted with a mixture composed of two parts bitumen to one part fine sand or granite dust. This mixture is applied in the following manner. The metal after spreading is steam rolled to the required camber, and the bitumen, after melting and heating to a temperature of about 240° F., has mixed with it in ordinary buckets, a 50% proportion of fine sand or granite dust—preferably the latter if available—which has also been heated to about the same temperature as the bitumen. The

mixture after thorough stirring is applied through hand pouring cans to the metalled surface, the covering area being about ·6 square yard per gallon. Stone chips are then spread evenly over the surface, which is finally steam rolled, when the road can be opened to traffic. The grout as applied in this manner has a penetration of about $2\frac{1}{2}$ inches; and after the road has been subjected to traffic conditions for a month or so, a sealing coat of bitumen or road tar may be given. This type of road may well be termed "Bitumastic macadam", and the lasting qualities of it have already been proved in this city, where roads so reconstructed in 1920 are still in excellent condition, and require very little attention for maintenance. The surface is resilient, clean, non-slippery and dust proof.

In addition to the Burma Oil Company, the British Burma Oil Company Limited, as advised by the writer, has succeeded in producing a residual asphalte or bitumen, which is of excellent quality for this class of work.

Asphalt roads.

The roads classified under this head consist of 2″ thick paving of Val de Travers Asphalte (powder) laid on a foundation of cement concrete 6″ thick. While the success of this kind of road cannot be denied, as they have had a useful life of over 15 years, yet their first cost is high, being Rs. 2 per square ft. for the asphalte alone, and maintenance charges have been heavy owing to the destructive effect on them of bullock and hand cart traffic, the narrow iron tyred wheels of which cause undue wear through biting and twisting action when in motion. Also it is difficult to obtain asphalte powder with the correct proportion of bitumen to suit the varying conditions of this climate, and for economic reasons, this form of road construction has not been proceeded with.

Granite sett paving.

This type of road is very suitable for roads in the vicinity of docks and railway where bullock, hand cart and heavy motor lorry traffic abounds. The construction consists of a foundation of 6″ thick cement concrete, reinforced if necessary, and granite stone setts laid thereon with a 1″ sand cushion between. The granite setts, which measure approximately 9″ × 5″ × 3″ and are obtained from India, are laid with joints as close as possible and these joints are flush grouted with a 2 : 1 fluid cement mortar. This form of pavement requires little or no attention for maintenance, roads which were so paved in the year 1912 are still in excellent condition and the maintenance charges on them have been practically nil.

Tarring.

As will be noted from a comparison of the 1928 classification with that of 1919, there has been a very considerable increase in the mileage of tar painted roads. Until recently it has been customary to use a tar obtainable from India, which conforms in every respect with the Road Board Specification for Tar No. 2, but it has always been realised that even this tar will volatilise and emulsify under the extreme monsoon conditions prevailing in Burma, and for the treatment of city streets it was not effective.

With bitumen becoming more readily available it is now usual to add to the tar 30 % by measure of bitumen which reinforces the former against the effects of damp. The provision of a really water-proof surface is thus obtained, and the use of tar alone is no longer economical.

BIHAR AND ORISSA, CENTRAL PROVINCES AND ASSAM.

In Bihar and Orissa there is little development of this nature to report. In the Central Provinces, *vide* the reply of that Government to question A. 6 of the questionnaire, the need for improved road surfaces has not at present been felt. In Assam again there is little to report.

GENERAL.

Improvement of unsurfaced roads.

The need for the improvement of unmetalled roads is also receiving attention at the present time. When it is remembered that some seventy per cent of the mileage of roads in charge of the Public Works Department and of district boards and councils, is unmetalled, and that in addition there is a large mileage of unmetalled roads in charge of minor local bodies and villagers, the importance of the subject will be realised. The main defects are inadequate drainage and soil unsuitable to carry loads. Attempts are being made in some provinces to deal with the former evil by schemes of remodelling and drainage, in the execution of which graders and other plant are being tested : the results as far as they go are encouraging but experience is at present very limited. Some work has also been done but to a still more limited extent upon the blending of soils to produce " sand-clay " and other improved surfaces.

Suggested policy regarding road research.

The above review of what has been done and what is being done with improved forms of road surface suggests the need of a central clearing house for information. It appeared from the evidence before the Committee and from the discussions of the touring sub-committee that the need for such a clearing house is generally accepted, and further that the Government of India might legitimately apply part of the funds at its disposal to subsidising research initiated by local Governments or by themselves. Some apprehension was however expressed lest central machinery for research be created on grandiose lines and result in heavy expenditure on academic investigations. This apprehension is possibly satisfied in that expenditure in this direction will be largely subject to the advice of the periodical road conference which will be able to appoint a technical sub-committee to consider proposals.

Subject to this advice, it appears probable that funds will be available for meeting the cost, wholly or in part, of experimental work in the field to be carried out by provincial road authorities ; for the provision of additional apparatus at Alipore and in other laboratories ; and for the publication, in periodical literature or special pamphlets, of information likely to be of use to road authorities, on road materials, road plant, road surfaces, and the effect of different classes of traffic, in India and other countries

APPENDIX V.

Federal Highway Act of 1921 of the United States of America.

An Act to amend the Act entitled "An Act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes," approved July 11, 1916, as amended and supplemented, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the Federal Highway Act. Federal Highway Act.

SEC. 2. That, when used in this Act, unless the context indicates otherwise— Meaning of terms.

The term "Federal Aid Act" means the Act entitled "An Act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes," approved July 11, 1916, as amended by sections 5 and 6 of an Act entitled "An Act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1920, and for other purposes," approved February 28, 1919, and all other Acts amendatory thereof or supplementary thereto. "Federal Aid Act."

The term "highway" includes rights of way, bridges, drainage structures, signs, guard rails, and protective structures in connection with highways, but shall not include any highway or street in a municipality having a population of two thousand five hundred or more as shown by the last available census, except that portion of any such highway or street along which within a distance of one mile the houses average more than two hundred feet apart. "Highway." Limitation.

The term "State highway department" includes any State department, commission, board, or official having adequate powers and suitably equipped and organized to discharge to the satisfaction of the Secretary of Agriculture the duties herein required. "State highway department."

The term "maintenance" means the constant making of needed repairs to preserve a smooth surfaced highway. "Maintenance."

The term "construction" means the supervising, inspecting, actual building, and all expenses incidental to the construction of a highway, except locating, surveying, mapping, and costs of rights of way. "Construction."

The term "reconstruction" means a widening or a rebuilding of the highway or any portion thereof to make it a continuous road, and of sufficient width and strength to care adequately for traffic needs. "Reconstruction."

The term "forest roads" means roads wholly or partly within or adjacent to and serving the national forests. "Forest roads."

The term "State funds" includes for the purposes of this Act funds raised under the authority of the State, or any political or other subdivision thereof, and made available for expenditure under the direct control of the State highway department. "State funds."

SEC. 3. All powers and duties of the Council of National Defense under the Act entitled "An Act making appropriations for the support of the Council of National Defense.

Powers of, in locating highways, etc., transferred to Secretary of Agriculture.

Army for the fiscal year ending June 30, 1917, and for other purposes," approved August 29, 1916, in relation to highway or highway transport, are hereby transferred to the Secretary of Agriculture, and the Council of National Defense is directed to turn over to the Secretary of Agriculture the equipment, material, supplies, papers, maps, and documents utilized in the exercise of such powers. The powers and duties of agencies dealing with highways in the national parks or in military or naval reservations under the control of the United States Army or Navy, or with highways used principally for military or naval purposes, shall not be taken over by the Secretary of Agriculture, but such highways shall remain under the control and jurisdiction of such agencies.

National parks, military and naval reservations.

Control of highways in, not disturbed.

Indian reservations.

Cooperative road construction in.

The Secretary of Agriculture is authorized to cooperate with the State highway departments, and with the Department of the Interior in the construction of public highways within Indian reservations, and to pay the amount assumed therefor from the funds allotted or apportioned under this Act to the State wherein the reservation is located.

Accounting division established.

SEC. 4. That the Secretary of Agriculture shall establish an accounting division which shall devise and install a proper method of keeping the accounts.

Surplus Army road construction materials, etc., transferred.

SEC. 5. That the Secretary of War be, and he is hereby, authorized and directed to transfer to the Secretary of Agriculture, upon his request, all war material, equipment, and supplies now or hereafter declared surplus from stock now on hand and not needed for the purposes of the War Department but suitable for use in the improvement of highways, and that the same shall be distributed among the highway departments of the several States to be used in the construction, reconstruction, and maintenance of highways, such distribution to be upon the same basis as that hereinafter provided for in this Act in the distribution of Federal-aid fund: *Provided*, That the Secretary of Agriculture, in his discretion, may reserve from such distribution not to exceed 10 per centum of such material, equipment, and supplies for use in the construction, reconstruction, and maintenance of national forest roads or other roads constructed, reconstructed, or maintained under his direct supervision.

Distribution for State use.

Proviso. Reservation for national forests, etc.

Interstate highways systems.

Preference to projects for connected, etc.

SEC. 6. That in approving projects to receive Federal aid under the provisions of this Act the Secretary of Agriculture shall give preference to such projects as will expedite the completion of an adequate and connected system of highways, interstate in character.

Mileage to be designated by States.

Before any projects are approved in any State, such State, through its State highway department, shall select or designate a system of highways not to exceed 7 per centum of the total highway mileage of such State as shown by the records of the State highway department at the time of the passage of this Act.

Federal aid thereto.

Upon this system all Federal-aid apportionments shall be expended.

Classification of highways.

Highways which may receive Federal aid shall be divided into two classes, one of which shall be known as primary or interstate highways, and shall not

exceed three-sevenths of the total mileage which may receive Federal aid, and the other which shall connect or correlate therewith and be known as secondary or intercounty highways, and shall consist of the remainder of the mileage which may receive Federal aid.

Approval, etc., of systems.

The Secretary of Agriculture shall have authority to approve in whole or in part the systems as designated or to require modifications or revisions thereof: *Provided*, That the States shall submit to the Secretary of Agriculture for his approval any proposed revisions of the designated systems of highways above provided for.

Proviso.

Proposed revisions.

Limitation until entire system provided for.

Not more than 60 per centum of all Federal aid allotted to any State shall be expended upon the primary or interstate highways until provision has been made for the improvement of the entire system of such highways. *Provided*, That with the approval of any State highway department the Secretary of Agriculture may approve the expenditure of more than 60 per centum of the Federal aid apportioned to such State upon the primary or interstate highways in such State.

Proviso.

Additional to primary highways.

Approval of prior projects permitted.

The Secretary of Agriculture may approve projects submitted by the State highway departments prior to the selection, designation, and approval of the system of Federal-aid highways herein provided for if he may reasonably anticipate that such projects will become a part of such system.

Additional mileage construction authorized when completion of 7 per cent provided for.

Whenever provision has been made by any State for the completion and maintenance of a system of primary or interstate and secondary or intercounty highways equal to 7 per centum of the total mileage of such State, as required by this Act, said State, through its State highway department, by and with the approval of the Secretary of Agriculture, is hereby authorized to add to the mileage of primary or interstate and secondary or intercounty systems as funds become available for the construction and maintenance of such additional mileage.

State to provide funds for construction before projects may be approved.

SEC. 7. That before any project shall be approved by the Secretary of Agriculture for any State such State shall make provisions for State funds required each year of such States by this Act for construction, reconstruction, and maintenance of all Federal-aid highways within the State, which funds shall be under the direct control of the State highway department.

Adequate construction materials, etc., required.

SEC. 8. That only such durable types of surface and kinds of materials shall be adopted for the construction and reconstruction of any highway which is a part of the primary or interstate and secondary or intercounty systems as will adequately meet the existing and probable future traffic needs and conditions thereon. The Secretary of Agriculture shall approve the types and width of construction and reconstruction and the character of improvement, repair, and maintenance in each case, consideration being given to the type and character which shall be best suited for each locality and to the probable character and extent of the future traffic.

Approval of types, etc., by Secretary.

Freedom from tolls.

SEC. 9. That all highways constructed or reconstructed under the provisions of this Act shall be free from tolls of all kinds.

Width of roadway, etc.

That all highways in the primary or interstate system constructed after the passage of this Act shall have a right of way of ample width and a wearing surface of an adequate width which shall not be less than eighteen feet, unless, in the opinion of the Secretary of Agriculture, it is rendered impracticable by physical conditions, excessive costs, probable traffic requirements, or legal obstacles.

Apportionment available on certificate from governor of action of State.

SEC. 10. That when any State shall have met the requirements of this Act, the Secretary of the Treasury, upon receipt of certification from the governor of such State to such effect, approved by the Secretary of Agriculture, shall immediately make available to such State, for the purpose set forth in this Act, the sum apportioned to such State as herein provided.

Submission of proposed projects.

SEC. 11. That any State having complied with the provisions of this Act, and desiring to avail itself of the benefits thereof, shall by its State highway department submit to the Secretary of Agriculture project statements setting forth proposed construction or reconstruction of any primary or interstate, or secondary or intercounty highway therein. If the Secretary of Agriculture approve the project, the State highway department shall furnish to him such surveys, plans, specifications, and estimates therefor as he may require; items included for engineering, inspection, and unforeseen contingencies shall not exceed 10 per centum of the total estimated cost of its construction.

Plans, etc., if project approved.

Notification of approval, etc.

That when the Secretary of Agriculture approves such surveys, plans, specifications, and estimates, he shall notify the State highway department and immediately certify the fact to the Secretary of the Treasury. The Secretary of the Treasury shall thereupon set aside the share of the United States payable under this Act on account of such projects, which shall not exceed 50 per centum of the total estimated cost thereof, except that in the case of any State containing unappropriated public lands exceeding 5 per centum of the total area of all lands in the State, the share of the United States payable under this Act on account of such projects shall not exceed 50 per centum of the total estimated cost thereof plus a percentage of such estimated cost equal to one-half of the percentage which the area of the unappropriated public lands in such State bears to the total area of such State: *Provided*, That the limitation of payments not to exceed $20,000 per mile, under existing law, which the Secretary of Agriculture may make be, and the same is hereby, increased in proportion to the increased percentage of Federal aid authorized by this section: *Provided further*, That these provisions relative to the public-land States shall apply to all unobligated or unmatched funds appropriated by the Federal Aid Act and payment for approved projects upon which actual building construction work had not begun on the 30th day of June, 1921.

Amount to be set aside therefor.

In public land States.

Provisos Limit increased.

Applicable to unused funds.

Construction, etc., by State highway departments.

Approval by Secretary, etc.

SEC. 12. That the construction and reconstruction of the highways or parts of highways under the provisions of this Act, and all contracts, plans, specifications, and estimates relating thereto, shall be undertaken by the State highway departments subject to the approval of the Secretary of Agriculture. The construction and reconstruction work and labor in each State shall be done in accordance with its laws and under the direct supervision of the State highway department, subject to the inspection and approval of the Secretary of Agriculture and in accordance with the rules and regulations pursuant to this Act.

SEC. 13. That when the Secretary of Agriculture shall find that any project approved by him has been constructed or reconstructed in compliance with said plans and specifications, he shall cause to be paid to the proper authorities of said State the amount set aside for said project. Payment on completion of project.

That the Secretary of Agriculture may, in his discretion, from time to time, make payments on such construction or reconstruction as the work progresses, but these payments, including previous payments, if any, shall not be more than the United States pro rata part of the value of the labor and materials which have been actually put into such construction or reconstruction in conformity to said plans and specifications. The Secretary of Agriculture and the State highway department of each State may jointly determine at what time and in what amounts payments as work progresses shall be made under this Act. Advances allowed during construction. Determination of payments.

Such payments shall be made by the Secretary of the Treasury, on warrants drawn by the Secretary of Agriculture, to such official or officials or depository as may be designated by the State highway department and authorized under the laws of the State to receive public funds of the State. Method of payments.

SEC. 14. That should any State fail to maintain any highway within its boundaries after construction or reconstruction under the provisions of this Act, the Secretary of Agriculture shall then serve notice upon the State highway department of that fact, and if within ninety days after receipt of such notice said highway has not been placed in proper condition of maintenance, the Secretary of Agriculture shall proceed immediately to have such highway placed in a proper condition of maintenance and charge the cost thereof against the Federal funds allotted to such State, and shall refuse to approve any other project in such State, except as hereinafter provided. Service of notice to State on failure to maintain highway. Procedure if not attended to. Other projects to be refused.

Upon the reimbursement by the State of the amount expended by the Federal Government for such maintenance, said amount shall be paid into the Federal highway fund for reapportionment among all the States for the construction of roads under this Act, and the Secretary of Agriculture shall then approve further projects submitted by the State as in this Act provided. Action if reimbursemen by the State.

Whenever it shall become necessary for the Secretary of Agriculture under the provisions of this Act to place any highway in a proper condition of maintenance the Secretary of Agriculture shall contract with some responsible party or parties for doing such work: *Provided, however*, That in case he is not able to secure a satisfactory contract he may purchase, lease, hire, or otherwise obtain all necessary supplies, equipment, and labor, and may operate and maintain such motor and other equipment and facilities as in his judgment are necessary for the proper and efficient performance of his functions. Authority of Secretary to contract for repairs, etc. *Proviso.* Work other than by contract.

SEC. 15. That within two years after this Act takes effect the Secretary of Agriculture shall prepare, publish, and distribute a map showing the highways and forest roads that have been selected and approved as a part of the primary or interstate, and the secondary or intercounty systems, and at least annually thereafter shall publish supplementary maps showing his program and the progress made in selection, construction, and reconstruction. Map of approved systems, etc., to be prepared. Annual supplements.

SEC. 16. That for the purpose of this Act the consent of the United States is hereby given to any railroad or canal company to convey to the Conveyance of public rights of way consented to.

highway department of any State any part of its right of way or other property in that State acquired by grant from the United States.

Use of public lands for rights of way or materials.

SEC. 17. That if the Secretary of Agriculture determines that any part of the public lands or reservations of the United States is reasonably necessary for the right of way of any highway or forest road or as a source of materials for the construction or maintenance of any such highway or forest road adjacent to such lands or reservations, the Secretary of Agriculture shall file with the Secretary of the department supervising the administration of such land or reservation a map showing the portion of such lands or reservations which it is desired to appropriate.

Application for.

Transfer to State authorities if not objected to.

If within a period of four months after such filing the said Secretary shall not have certified to the Secretary of Agriculture that the proposed appropriation of such land or material is contrary to the public interest or inconsistent with the purposes for which such land or materials have been reserved, or shall have agreed to the appropriation and transfer under conditions which he deems necessary for the adequate protection and utilization of the reserve, then such land and materials may be appropriated and transferred to the State highway department for such purposes and subject to the conditions so specified.

Reversion when no longer needed.

If at any time the need for any such lands or materials for such purposes shall no longer exist, notice of the fact shall be given by the State highway department to the Secretary of Agriculture, and such lands or materials shall immediately revert to the control of the Secretary of the department from which they had been appropriated.

Rules, etc., to be prescribed.

SEC. 18. That the Secretary of Agriculture shall prescribe and promulgate all needful rules and regulations for the carrying out of the provisions of this Act, including such recommendations to the Congress and the State highway departments as he may deem necessary for preserving and protecting the highways and insuring the safety of traffic thereon.

Annual detailed statements from Secretary.

SEC. 19. That on or before the first Monday in December of each year the Secretary of Agriculture shall make a report to Congress, which shall include a detailed statement of the work done, the status of each project undertaken, the allocation of appropriations, an itemized statement of the expenditures and receipts during the preceding fiscal year under this Act, an itemized statement of the travelling and other expenses, including a list of employees, their duties, salaries, and travelling expenses, if any, and his recommendations, if any, for new legislation amending or supplementing this Act. The Secretary of Agriculture shall also make such special reports as Congress may request.

Special report.

Appropriation for fiscal year 1922.

SEC. 20. That for the purpose of carrying out the provisions of this Act there is hereby appropriated, out of the moneys in the Treasury not otherwise appropriated, $75,000,000 for the fiscal year ending June 30, 1922, $25,000,000 of which shall become immediately available, and $50,000,000 of which shall become available January 1, 1922.

Administration, etc., expenses to be deducted.

SEC. 21. That so much, not to exceed 2½ per centum, of all moneys hereby or hereafter appropriated for expenditure under the provisions of this Act, as the Secretary of Agriculture may deem necessary for administering

the provisions of this Act and for carrying on necessary highway research and investigational studies independently or in cooperation with the State highway departments and other research agencies, and for publishing the results thereof, shall be deducted for such purposes, available until expended.

Apportionment of unexpended balances.

Within sixty days after the close of each fiscal year the Secretary of Agriculture shall determine what part, if any, of the sums theretofore deducted for such purposes will not be needed and apportion such part, if any, for the fiscal year then current in the same manner and on the same basis as are other amounts authorized by this Act apportioned among all the States, and shall certify such apportionment to the Secretary of the Treasury and to the State highway departments.

Ratio of apportionment.

The Secretary of Agriculture, after making the deduction authorized by this section, shall apportion the remainder of the appropriation made for expenditure under the provision of the Act for the fiscal year among the several States in the following manner: One-third in the ratio which the area of each State bears to the total area of all the States; To area. one-third in the ratio which the population of each State bears to the total population of all the States, as shown by the latest available Federal census: To population. one-third in the ratio which the mileage of rural delivery routes and star routes in each State bears to the total mileage of rural delivery and star routes in all the States at the close of the next preceding fiscal year, as shown by certificate of the Postmaster General, which he is directed to make and furnish annually to the Secretary of Agriculture: *Provided*, That no State shall receive less than one-half of 1 per centum of each year's allotment. All moneys herein or hereafter appropriated for expenditure under the provisions of this Act shall be available until the close of the second succeeding fiscal year for which apportionment was made: *Provided further*, That any sums apportioned to any State under the provisions of the Act entitled "An Act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes," approved July 11, 1916, and all Acts amendatory thereof and supplemental thereto, shall be available for expenditure in that State for the purpose set forth in such Acts until two years after the close of the respective fiscal years for which any such sums become available, and any amount so apportioned remaining unexpended at the end of the period during which it is available for expenditure under the terms of such Acts shall be reapportioned according to the provisions of the Act entitled "An Act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes," approved July 11, 1916: *And provided further*, That any amount apportioned under the provisions of this Act unexpended at the end of the period during which it is available for expenditure under the terms of this section shall be reapportioned within sixty days thereafter to all the States in the same manner and on the same basis, and certified to the Secretary of the Treasury and the State highway departments in the same way as if it were being apportioned under this Act for the first time.

To rural delivery and star routes mileage.

Provisos. Minimum.

Available for succeeding year.

Apportionment under former laws available for two years.

Unexpended balances to be apportioned according to same laws.

Reapportionment of unexpended balances to States.

Certification of amounts apportioned for each year.

SEC. 22. That within sixty days after the approval of this Act the Secretary of Agriculture shall certify to the Secretary of the Treasury and to each of the State highway departments the sum he has estimated to be deducted for administering the provisions of this Act and the sums which he

has apportioned to each State for the fiscal year ending June 30, 1922, and on or before January 20 next preceding the commencement of each succeeding fiscal year, and shall make like certificates for each fiscal year.

National forests. Appropriation for roads and trails in, for 1922 and 1923.

SEC. 23. That out of the moneys in the Treasury not otherwise appropriated, there is hereby appropriated for the survey, construction, reconstruction, and maintenance of forest roads and trails, the sum of $5,000,000 for the fiscal year ending June 30, 1922, available immediately and until expended, and $10,000,000 for the fiscal year ending June 30, 1923, available until expended.

Amount authorized for roads and trails of primary importance to national forests.

(a) Fifty per centum, but not to exceed $3,000,000 for any one fiscal year, of the appropriation made or that may hereafter be made for expenditure under the provisions of this section shall be expended under the direct supervision of the Secretary of Agriculture in the survey, construction, reconstruction, and maintenance of roads and trails of primary importance for the protection, administration, and utilization of the national forests, or when necessary, for the use and development of resources upon which communities within or adjacent to the national forests are dependent, and shall be apportioned among the several States, Alaska, and Porto Rico by the Secretary of Agriculture, according to the relative needs of the various national forests, taking into consideration the existing transportation facilities, value of timber, or other resources served, relative fire danger, and comparative difficulties of road and trail construction.

To develop resources of adjacent communities, etc. Apportionment.

Balance for roads of primary importance to adjacent communities, etc. Apportionment.

The balance of such appropriations shall be expended by the Secretary of Agriculture in the survey, construction, reconstruction, and maintenance of forest roads of primary importance to the State, counties, or communities within, adjoining, or adjacent to the national forests, and shall be prorated and apportioned by the Secretary of Agriculture for expenditures in the several States, Alaska, and Porto Rico, according to the area and value of the land owned by the Government within the national forests therein as determined by the Secretary of Agriculture from such information, investigation, sources, and departments as the Secretary of Agriculture may deem most accurate.

Acceptance of State, etc., cooperation.

(b) Cooperation of Territories, States, and civil subdivisions thereof may be accepted but shall not be required by the Secretary of Agriculture.

Construction by States, etc.

(c) The Secretary of Agriculture may enter into contracts with any Territory, State, or civil subdivision thereof for the construction, reconstruction, or maintenance of any forest road or trail or part thereof.

Contracts for construction work.

(d) Construction work on forest roads or trails estimated to cost $5,000 or more per mile, exclusive of bridges, shall be advertised and let to contract.

Work by the Secretary.

If such estimated cost is less than $5,000 per mile, or if, after proper advertising, no acceptable bid is received, or the bids are deemed excessive, the work may be done by the Secretary of Agriculture on his own account; and for such purpose the Secretary of Agriculture may purchase, lease, hire, rent, or otherwise obtain all necessary supplies, materials, tools, equipment, and facilities required to perform the work.

Use of appropriations for expenses.

The appropriation made in this section or that may hereafter be made for expenditure under the provisions of this section may be expended for the

purpose herein authorized and for the payment of wages, salaries, and other expenses for help employed in connection with such work.

Temporary approval of projects when State laws do not allow use of its funds.

SEC. 24. That in any State where the existing constitution or laws will not permit the State to provide revenues for the construction, reconstruction, or maintenance of highways, the Secretary of Agriculture shall continue to approve projects for said State until three years after the passage of this Act, if he shall find that said State has complied with the provisions of this Act in so far as its existing constitution and laws will permit.

Invalidity of any provision, etc., not to affect remainder of Act.

SEC. 25. That if any provision of this Act, or the application thereof to any person or circumstances, shall be held invalid, the validity of the remainder of the Act and of the application of such provision to other persons or circumstances shall not be affected thereby.

Inconsistent laws repealed.

SEC. 26. That all Acts or parts of Acts in any way inconsistent with the provisions of this Act are hereby repealed, and this Act shall take effect on its passage.

Approved, November 9, 1921.